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NEARSHORE BENTHOS OF LAKE ONTARIO 1981 AND 1991

VOLUME II - APPENDICES

JULY 1995

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1981 AND 1991

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NEARSHORE BENTHOS OF LAKE ONTARIO

1981 AND 1991

VOLUME II - APPENDICES

Report prepared by:

Water Systems Analysts

Report prepared for:

Ontario Ministry of Environment and Energy
Environmental Monitoring and Reporting Branch
Surface Water Section

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APPENDIX A

QA/QC DATA FOR SORTING

APPENDIX A. QA/QC DATA FOR SORTING

A.1 INTRODUCTION

To ensure that there was a high degree of efficiency in removing invertebrates from benthic samples collected from Lake Ontario, we implemented a Quality Assurance/Quality Control (QA/QC) program. This appendix describes the work that was conducted to determine how efficient various technicians were during initial sorting of benthos samples.

A.2 METHODOLOGY

During initial sorting, samples were split into four parts (quarters). Benthic invertebrates were removed from quarters until approximately 2 hours had elapsed. During sorting, large invertebrates were removed first, and the sample was scanned under a stereo microscope at > 12x magnification. During resorting (QA/QC checking), sub-samples that had been processed were re-processed as if it was the first time. Samples were re-scanned under a stereo microscope at 6-12x magnification, and the numbers of invertebrates found were recorded.

A.3 RESULTS

A total of 20 samples were resorted (Table B.1). The most commonly missed organisms were insects (mostly chironomids), molluscs (mostly Pisidium), and oligochaetes. In six of the eight samples where >5% of the invertebrates were missed, the samples were collected from the shallow sites (5 m depth). Technician AC, missed more invertebrates, in general, than did the other two technicians used during the initial sorting.

A.4 DISCUSSION

The QA/QC data collected during this study identified some problems with the original sorting. In general, more invertebrates were missed in samples collected from the shallow-water sites than in samples collected from the deep-water sites. In addition, there were substantial problems with technician AC, who missed more invertebrates than did the other two technicians, especially at the shallow water stations. Consequently, all of the samples processed by technician AC from the shallow-water sites were re-sorted. Samples from the shallow-water sites may have been sorted less efficiently because of differences in physical characteristics. Deep-water sites were usually made up of finer material, whereas, shallower sites tended to have more Cladophora (Appendix A). The presence of Cladophora is likely responsible for the difficulties because small insects such as chironomids, and worms, tend to become entangled in the masses of Cladophora, making them more difficult to see.

The sorting efficiency of the personnel used was as good or better than efficiencies observed for other personnel, from other laboratories. W. Gibbons and M. Paine (E.V.S. Consultants, pers. comm.) have used a similar QA/QC program and found that technicians missed between 3 and 50% (avg. ≈ 15%) of the taxa in benthic samples. Apparently these results came from a laboratory using technicians with, in most cases, ≥ 2 years experience. We are unaware of any other laboratories that have conducted QA/QC work and reported the data.

Table A.1 Numbers of benthic invertebrates missed during sorting.

Sample No.	Tech	Crustacea	Insecta	Mollusca	Oligochaeta	Other Taxa	Total Re-picked	Total Initially Picked	% Missed
1-20-1	MT	0	0	0	1	0	1	78	1.3
3-20-3	AC	0	0	4	2	0	6	118	5.1
5-5-2	MT	0	2	16	51	2	71	866	7.4
6-5-1	AC	0	2	7	7	1	17	261	6.1
6-20-2	WC	0	0	0	4	0	4	245	1.6
8-5-2	WC	0	1	0	8	0	9	722	1.2
10-20-3	AC	0	0	0	3	1	4	132	3.0
12-5-2	AC	0	8	0	29	2	39	379	9.5
13-5-1	AC	0	0	0	0	0	0	26	0
15-20-2	AC	0	1	1	3	1	6	174	3.4
16-5-1	WC	0	4	1	7	0	12	186	6.5
17-5-3	AC	4	12	8	7	2	33	332	9.0
17-20-1	WC	0	0	1	2	0	3	175	1.7
18-20-1	MT	0	0	0	0	1	1	301	0.3
18-20-2	MT	0	0	1	9	0	11	135	7.5
19-5-2	WC	4	5	3	3	0	15	594	2.5
21-20-2	MT	0	1	5	8	1	15	282	5.1
22-5-3	MT	0	1	6	0	0	7	217	3.3
24-5-1	AC	2	7	5	2	2	18	228	7.3
24-5-2	WC	0	0	0	1	0	1	29	3.3

APPENDIX B

EFFECTS OF SUB-SAMPLING ON DENSITY ESTIMATES

APPENDIX B. EFFECTS OF SUB-SAMPLING ON DENSITY ESTIMATES

B.1 INTRODUCTION

Many studies that examine the distribution of benthic invertebrates collect samples that are too large to be fully processed. Samples are therefore split, or sub-sampled, to reduce the costs associated with processing. However, we have not been able to find any reports that attempt to determine the effects of sub-sampling on density estimates for benthic taxa.

Sub-sampling can have a number of effects, including:

(1) rare taxa in a sample may be missed if they are not present in the sub-sample examined;

(2) rare taxa in a sample may be given more importance than they deserve if they are present in a sub-sample that represents a small proportion of the total sample; and,

(3) sub-sampling adds another source of experimental error to estimates of density.

Effects 1 and 2 cannot be controlled. Effect 3 becomes a problem if the experimental error is increased to the point that it becomes difficult to distinguish differences in communities among samples. It also becomes a problem if the increase in variation in density estimates is different for different taxa (i.e., if the sample splitting technique is better for evenly distributing some taxa among the sub-samples, while is poor at evenly distributing other taxa among the sub-samples). The objective of this appendix is to describe the effect of sub-sampling on the variance (σ^2) term of density estimates for major taxa, using sub-sample data.

B.2 METHODOLOGY

All but 27 of the 153 benthos samples from Lake Ontario were sub-sampled. The sub-sampling technique consisted of putting all of the debris from the benthos sample into a white bottomed tray, spreading it evenly by eye, and splitting the sample into four equal parts (also by eye).

Successive sub-samples were processed for an average of two hours. The numbers of crustaceans, oligochaetes, molluscs, insects and "other" taxa were recorded for each sub-sample that was processed.

Each of the twenty-seven samples that were completely sorted were split into four equal parts (using the same sub-sampling scheme described above), and the numbers of organisms in each part were recorded. Molluscs were present in all of those samples, crustaceans in 20, insects in 23 and oligochaetes in 25. For each group (taxon) that was present in a sample, there were four estimates of the density of that group. From these four estimates per sample, the mean and variance were calculated. To determine if the sub-sampling technique added different variation to density estimates for different taxa, analysis of variance was used to test for differences in estimates of variance among the groups of taxa. Mean density of a taxon is related to the variance, so it was used as a covariate in the analysis. Both mean density and variance were $\log_e$ transformed prior to analysis. The coefficient of variation (CV) was illustrated to indicate the effects of sub-sampling on the variance of density estimates for each of the major taxa. Coefficients of variation are simply $\sqrt{\sigma^2}$/mean (=σ/mean). Therefore, the results from an analysis of variance of the σ^2 terms using mean density as a covariate, and an illustration with the CVs should both provide the same conclusion. Illustrating the CVs is conceptually easier than illustrating the residuals from ANCOVA, and ratios (i.e., the CVs) are usually not considered appropriate for ANOVA.

B.3 RESULTS AND DISCUSSION

The CVs of sub-samples ranged between 200% for samples that had less than five invertebrates to approximately 30-50% for sub-samples that had more than 60 invertebrates. This is as high or higher than is normally found within stations. Usually, CVs near 20% are preferred (Morin, 1985), however, CVs for samples within stations often approximate 50-100% (e.g., Munkittrick et al., 1991).

There was no significant difference in σ^2 terms among the four taxa after correcting for numbers found (Table C.1), suggesting that the sub-sampling technique did not affect the variance of density estimates for taxa differentially. This indicates that when samples are spread evenly in white enamel pans, no one taxonomic group is spread more evenly than others.

B.4 REFERENCES

Morin, A. 1985. Variability of density estimates and the optimization of sampling programs for stream benthos. Can. J. Fish. Aq. Sci. 42:1530-1534.

Munkittrick, K. R., B. W. Kilgour, W. N. Gibbons, W. M. Gibson, G. A. Vigers. 1991. Baseline environmental studies of the Lesser Slave River. Volume I. Prepared by E.V.S. Consultants for the Slave Lake Pulp Corporation. 129 pp + appendices.

Table B.1. Analysis of variance table to determine if the variance of sub-sample density estimates was different among four taxonomic groups (crustaceans, oligochaetes, molluscs, insects).

Source	df	SS	MS	F-ratio	P-value
Taxon	3	0.238	0.079	0.187	0.899
Density	1	316.72	316.72	252.67	<0.001
Taxon·Density	3	1.272	0.424	0.338	0.798
Error	86	107.80	1.253		

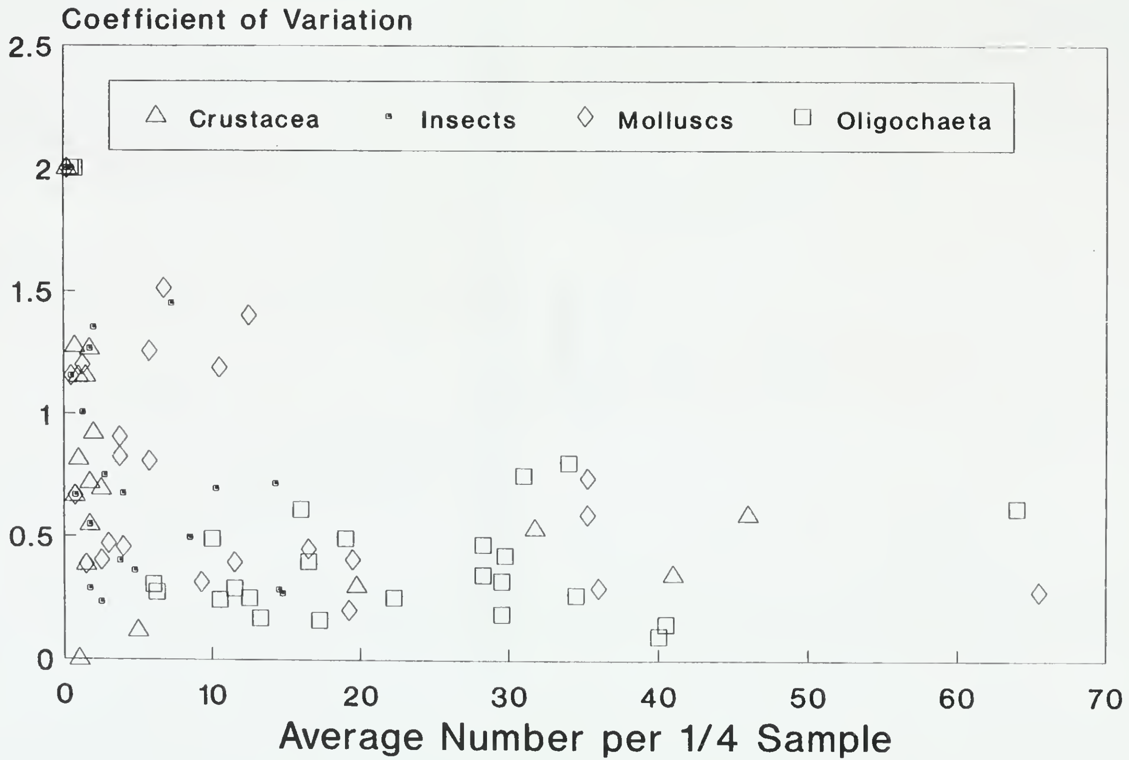


Figure B.1 Distribution of the coefficient of variation for four benthos groups.

APPENDIX C

RAW MEIO-SCALE BENTHOS DATA FROM LAKE ONTARIO - 1991

APPENDIX C.

RAW MEIOBENTHOS DATA FROM LAKE ONTARIO - 1981 & 1991

This appendix includes data for both the 1981 and 1991 surveys of Lake Ontario only. Raw data for the 1981 survey include the taxon name changes identified in Volume I of this report. For the original data see the report by Integrated Explorations (A nearshore benthic survey of Lake Ontario, I.E Report #PJ8102, May, 1984). Copies of both the 1981 and 1991 data are available as SAS data files or Lotus spreadsheets from Todd Howell (MOEE), or Bruce Kilgour (WSA).

DATA APPENDIX
LAKE ONTARIO BENTHIC INVERTEBRATES
1981 AND 1991 COMPARISON

Results for:

1981, 5m depth

- numbers per sample
- sample area was 78 cm^2 (sample area code 1)
- lower size limit was 200 um

Table 1: Benthic invertebrate data listing for 1981, transect 1 (Niagara-on-the-lake), 5m depth. Data are for number of individuals in three replicate samples.

Gammarus fasciatus	4	20	6
Gyraulus parvus	0	1	0
Physella gyrina	1	6	5
Pleurocera acuta	1	0	0
Valvata sincera	0	0	1
Slavina appendiculata	0	1	0
Stylaria lacustris	1	8	1
Vejdovskyella intermedia	0	6	0
Peloscolex ferox	0	1	0
sample area code	1	1	1

Table 2: Benthic invertebrate data listing for 1981, transect 2 (Port Dalhousie), 5m depth. Data are for number of individuals in three replicate samples.

Oecetis spp a	0	3	0
Gammarus fasciatus	3	4	9
Tanytarsus spp	0	0	1
Heterotrissocladius spp	0	0	12
Bythinia tentaculata	1	5	1
Physella gyrina	1	0	1
Muculium transversum	0	0	1
Sphaerium nitidum	0	0	1
Pisidium casertanum	0	0	2
Pisidium henslowanum	0	0	1
Aelosoma spp	0	1	1
Chaetogaster diaphanus	0	2	0
Nais variabilis	2	1	2
Vejdovskyella intermedia	1	0	0
im. tubificids w/o hair setae	0	1	0
Aulodrilus limnobius	0	2	0
Potamathrix vejdovskyi	1	0	0
Peloscolex ferox	1	0	0
sample area code	1	1	1

Table 3: Benthic invertebrate data listing for 1981, transect 3 (Jordan Harbour), 5m depth. Data are for number of individuals in three replicate samples.

Gammarus fasciatus	4	27	3
Chironomus fluviatilis	0	1	1
Cryptochironomus spp	4	2	1
Dicrotendipes fumidus	0	1	0
Endochironomus spp	0	1	0
Parachironomus spp	0	4	0
Polypedilum scalaenum	1	0	0
Stictochironomus spp	5	24	6
Monodiamesa tuberculata	1	0	0
Tanytarsus spp	4	20	10
Heterotrissocladius changi	3	2	3
Ablabesmyia spp	0	0	1
Pisidium casertanum	9	4	16
Pisidium fallax	1	8	5
Pisidium henslowanum	2	0	0
Chaetogaster diaphanus	2	19	0
Nais simplex	1	0	0
Nais variabilis	15	0	0
Piguetiella michiganensis	10	0	0
Uncinais uncinata	5	0	0
Vejdovskyella intermedia	91	58	104
im. tubificids w/o hair setae	53	0	0
Peloscolex freyi	2	0	0
Potamathrix moldaviensis	0	1	0
Tubifex embryos	13	13	7
sample area code	1	1	1

Table 4: Benthic invertebrate data listing for 1981, transect 4 (Beamsville), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralis	1	0	0
Hydroptila	7	3	6
Hyalella azteca	12	2	8
Parachironomus spp	0	1	0
Paralauterborniella spp	0	1	0
Rheotanytarsus spp	1	0	0
Tanytarsus spp	2	3	0
Heterotrissocladius changi	0	1	0
Orthocladius spp	0	1	0
Ablabesmyia spp	0	4	1
Amnicola limosa	0	1	0
Bythinia tentaculata	2	1	0
Helisoma anceps	11	3	0
Physella gyrina	3	1	1
Pleurocera acuta	1	1	0
Pisidium variabile	0	2	2
Manayunkia speciosa	0	0	5
Chaetogaster diaphanus	15	3	8
Nais pardalis	1	14	4
Nais simplex	1	0	0
Nais variabilis	0	2	1
Stylaria lacustris	20	11	9
Vejdovskyella intermedia	23	9	5
im. tubificids w/o hair setae	1	1	1
Peloscolex ferox	0	1	0
sample area code	1	1	1

Table 5: Benthic invertebrate data listing for 1981, transect 5 (Stoney Creek), 5m depth. Data are for number of individuals in three replicate samples.

Hydroptilla	1	0	0
Diaporeia spp	0	1	0
Gammarus lacustris	0	1	2
Chironomus anthracinus	0	0	2
Cladopelma spp	2	0	2
Cryptochironomus spp	0	1	0
Parachironomus spp	3	0	0
Paracladopelma spp	0	1	1
Paralauterborniella spp	0	2	48
Polypedilum scalaenum	22	27	39
Stictochironomus spp	0	1	3
Monodiamesa spp	3	5	2
Potthastia spp	1	1	0
Micropsectra spp	0	0	1
Tanytarsus spp	10	4	20
Heterotrissocladius changi	5	6	9
Orthocladius spp	1	0	1
Psectrocladius spp	1	0	1
Thienemanniella spp	9	4	6
Ablabesmyia spp	3	2	1
Procladius spp	3	0	6
Physella gyrina	0	0	1
Pisidium casertanum	6	25	6
Pisidium henslowanum	2	23	14
Pisidium variabile	0	2	0
Chaetogaster diaphanus	87	3	8
Nais variabilis	6	0	11
Piguetiella michiganensis	3	0	4
Slavina appendiculata	6	0	2
Specaria josinae	0	0	1
Stylaria lacustris	17	1	5
Uncinais uncinata	61	0	36
Vejdovskyella intermedia	11	55	50
im. tubifids w hair setae	3	460	22
im. tubificids w/o hair setae	120	881	163
Aulodrilus limnobius	3	0	29
Aulodrilus pluriseta	6	26	18
Limnodrilus hoffmeisteri	3	13	7
Potamathrix moldaviensis	12	46	40
Potamathrix vejdovskyi	9	66	4
Tubifex ignotus	0	1	0
Tubifex embryos	23	8	21
sample area code	1	1	1

Table 6: Benthic invertebrate data listing for 1981, transect 6 (Hamilton Beach), 5m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	15	0	13
Chironomus fluviatilis	0	2	0
Cryptochironomus spp	0	2	2
Paralauterborniella spp	0	0	2
Polypedilum scalaenum	1	2	0
Monodiamesa tuberculata	1	13	8
Tanytarsus spp	1	1	1
Heterotrissocladius changi	2	1	4
Orthocladius spp	0	0	1
Procladius spp	0	0	1
Pisidium casertanum	0	2	0
Pisidium henslowanum	0	2	0
Uncinaie uncinata	1	12	2
Vejdovskyella intermedia	131	472	175
Potamathrix moldaviensis	20	34	39
Potamathrix vejdovskyi	1	5	9
sample area code	1	1	1

Table 7: Benthic invertebrate data listing for 1981, transect 7 (Bronte), 5m depth. Data are for number of individuals in three replicate samples.

Gammarus fasciatus	4	0	10
Hyalella azteca	0	4	3
Caecidotea racovitzae	5	0	6
Polypedilum scalaenum	0	0	1
Cricotopus spp	0	2	3
Heterotrissocladius changi	0	0	1
Thienemanniella spp	0	1	0
Ablabesmyia spp	0	2	0
Procladius spp	0	0	1
Gyraulus parvus	1	0	0
Physella gyrina	3	0	4
Pleurocera acuta	0	0	1
Stagnicola emarginata	1	3	1
Valvata sincera	0	1	0
Valvata tricarinata	0	1	0
Sphaerium striatinum	1	0	0
Pisidium casertanum	3	0	0
Pisidium compressum	2	0	0
Pisidium cruciatum	1	0	0
Pisidium henslowanum	1	0	0
Stylodrilus heringianus	0	0	1
Chaetogaster diaphanus	2	5	2
Chaetogaster diastrophus	0	4	0
Nais bretscheri	2	0	2
Nais variabilis	0	3	6
Stylaria lacustris	2	22	5
Vejdovskyella intermedia	60	1	35
im. tubificide w/o hair setae	3	0	0
sample area code	1	1	1

Table 8: Benthic invertebrate data listing for 1981, transect 8 (Oakville), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralis	4	0	0
Prostoma graecense	3	0	0
Diaporeia spp	0	13	0
Gammarus fasciatus	1	0	0
Caecidotea racovitzae	0	1	0
Cladopelma spp	1	0	0
Dicrotendipes fumidus	5	0	2
Cricotopus spp	2	1	3
Psectrocladius spp	1	0	0
Thienemanniella spp	10	5	0
Ablabesmyia spp	11	0	0
Gyraulus parvus	0	0	1
Physella gyrina	7	0	1
Pleurocera acuta	1	0	0
Pisidium amnicum	1	0	0
Pisidium casertanum	4	0	0
Chaetogaster diaphanus	59	4	6
Chaetogaster diastrophus	11	0	0
Nais bretscheri	61	1	0
Nais communis	7	0	0
Nais simplex	2	0	0
Nais variabilis	30	0	1
Stylaria lacustris	96	3	17
Vejdovskyella intermedia	37	2	11
im. tubifids w hair setae	1	0	0
im. tubificids w/o hair setae	2	0	0
Limnodrilus hoffmeisteri	0	1	0
Potamathrix vejdovskyi	4	0	0
sample area code	1	1	1

Table 9: Benthic invertebrate data listing for 1981, transect 9 (Etobicoke), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralie	8	2	4
Gammarus fasciatus	16	6	188
Hyalella azteca	6	8	112
Caecidotea racovitzae	6	0	40
Dicrotendipes fumidus	0	0	16
Dicrotendipes neomodestus	0	0	4
Endochironomus spp	0	3	36
Parachironomus spp	0	1	8
Phaenopsectra spp	0	0	4
Potthastia spp	0	1	12
Cricotopus spp	2	0	32
Cricotopus tremulus	2	4	0
Heterotrissocladius changi	0	1	0
Orthocladius spp	2	0	32
Thienemanniella spp	0	4	44
Larsia spp	0	0	76
Procladius spp	6	0	0
Physella gyrina	4	0	4
Stagnicola emarginata	4	0	0
Valvata piscinalis	0	0	4
Valvata sincera	16	4	16
Musculium partumeium	2	0	0
Sphaerium nitidum	0	0	4
Pisidium amnicum	2	0	0
Pisidium casertanum	52	6	12
Pisidium compressum	4	0	4
Pisidium conventus	2	0	0
Pisidium fallax	44	0	0
Pisidium henslowanum	4	1	36
Pisidium lilljeborgi	4	0	0
Pisidium subtruncatum	14	0	0
Pisidium variabile	2	0	0
Pisidium ventricosum	12	0	12
Stylodrilus heringianus	0	0	4
Chaetogaster diaphanus	206	85	980
Nais bretscheri	22	1	22
Nais elinguis	0	0	11
Nais pseudobtusa	0	1	11
Nais variabilis	11	1	11
Ophidonais serpentina	6	4	44
Slavina appendiculata	8	4	4
Stylaria lacustris	2	16	96
Uncinais uncinata	0	2	0
Vejdovskyella intermedia	1244	612	1099
im. tubifids w hair setae	445	28	188
im. tubificids w/o hair setae	393	57	271
Aulodrilus pluriseta	56	8	11
Limnodrilus cervix	2	0	0
Limnodrilus hoffmeisteri	20	1	22
Peloscolex ferox	17	2	12
Potamothrix moldaviensis	0	2	0
Potamothrix vejdovskyi	48	42	22
Tubifex ignotus	2	1	0
Tubifex tubifex	63	5	44
Tubifex embryos	484	24	156
sample area code	1	1	1

Table 10: Benthic invertebrate data listing for 1981, transect 10 (Humber Bay), 5m depth. Data are for number of individuals in three replicate samples.

Crangonyx gracilis	1	0	0
Gammarus fasciatus	15	24	76
Caecidotea racovitzae	0	19	2
Chironomus anthracinus	0	1	1
Cryptochironomus spp	1	0	0
Dicrotendipes fumidus	0	0	10
Parachironomus spp	0	5	2
Cricotopus curtus	0	1	2
Cricotopus ornatus	1	0	3
Nanocladius spp	0	1	1
Pleurocera acuta	0	0	2
Valvata piscinalis	0	1	0
Sphaerium nitidum	1	0	4
Pisidium casertanum	0	0	2
Pisidium compressum	0	0	4
Pisidium fallax	0	0	4
Pisidium ventricosum	0	0	2
Manayunkia speciosa	0	1	0
Oligochaeta	0	1044	913
Chaetogaster diaphanus	40	126	44
Nais barbata	0	5	43
Nais simplex	0	0	21
Nais variabilis	2	13	43
Ophidonais serpentina	39	65	170
Stylaria lacustris	23	70	111
Vejdovskyella intermedia	2	7	64
im. tubifids w hair setae	63	630	945
im. tubificids w/o hair setae	21	388	473
Aulodrilus pluriseta	1	0	43
Limnodrilus cervix	0	0	21
Peloscolex ferox	4	0	86
Peloscolex multisetosus	0	2	0
Tubifex tubifex	0	13	43
Tubifex embryos	18	149	86
sample area code	1	1	1

Table 11: Benthic invertebrate data listing for 1981, transect 11 (Toronto Island), 5m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	1	0	0
Cryptochironomus spp	0	0	1
Nais communis	1	0	0
Nais elinguis	13	3	10
Vejdovskyella intermedia	2	1	3
Tubifex embryos	1	0	0
sample area code	1	1	1

Table 12: Benthic invertebrate data listing for 1981, transect 12 (Birch Cliff), 5m depth. Data are for number of individuals in three replicate samples.

Prostoma graecense	4	14	6
Diaporeia spp	2	0	1
Chironomus spp	0	1	1
Cladopelma spp	1	0	0
Polypedilum scalaenum	1	0	1
Tanytarsus spp	0	0	1
Cricotopus spp	0	1	0
Cricotopus tremulus	3	1	5
Heterotrissocladius changi	4	5	17
Parakiefferiella spp	0	1	0
Enchytraeidae	0	0	1
Amphichaeta spp	0	1	1
Chaetogaster diaphanus	4	16	17
Nais barbata	2	6	1
Nais bretscheri	4	6	13
Nais elinguis	4	7	8
Nais variabilis	10	18	29
Stylaria lacustris	1	3	1
Vejdovskyella intermedia	149	238	476
im. tubificids w/o hair setae	0	0	2
Tubifex embryos	0	1	0
sample area code	1	1	1

Table 13: Benthic invertebrate data listing for 1981, transect 13 (Guildwood), 5m depth. Data are for number of individuals in three replicate samples.

Prostoma graecense	10	6	2
Diaporeia spp	1	1	1
Chironomus spp	0	3	0
Cryptochironomus spp	2	5	3
Paraclodpelma winnelli	3	2	3
Polypedilum scalaenum	0	5	3
Tanytarsus spp	0	0	1
Cricotopus tremulus	0	0	2
Heterotrissocladius changi	13	31	15
Amphichaeta spp	0	17	2
Nais elinguis	2	4	10
Nais variabilis	3	3	9
Piguetiella michiganensis	8	25	27
Stylaria lacustris	1	0	1
Uncinais uncinata	1	2	6
Vejdovskyella intermedia	269	866	407
im. tubifids w hair setae	0	0	1
im. tubificids w/o hair setae	30	79	0
Limnodrilus hoffmeisteri	0	5	5
Potamathrix moldaviensis	0	2	1
Tubifex embryos	17	55	31
sample area code	1	1	1

Table 14: Benthic invertebrate data listing for 1981, transect 14 (Whitby), 5m depth. Data are for number of individuals in three replicate samples.

Hydroptila	0	0	1
Prostoma graecense	2	4	3
Gammarus fasciatus	8	14	12
Caecidotea racovitzae	0	1	1
Cryptochironomus spp	0	1	0
Dicrotendipes fumidus	0	1	0
Paratendipes spp	2	1	2
Tanytarsus spp	1	4	0
Cricotopus spp	0	0	1
Cricotopus tremulus	2	5	1
Heterotrissocladius changi	3	0	0
Orthocladius spp	1	0	0
Thienemanniella spp	1	8	2
Procladius spp	0	1	0
Gyraulus parvus	0	1	0
Helisoma anceps	1	0	0
Enchytraeidae	0	1	0
Chaetogaster diaphanus	11	17	0
Chaetogaster diastrophus	0	1	0
Nais bretscheri	4	2	4
Nais simplex	1	1	0
Nais variabilis	10	10	15
Slavina appendiculata	1	4	1
Stylaria lacustris	46	43	44
Uncinais uncinata	0	2	0
Vejdovskyella intermedia	149	169	23
im. tubifids w hair setae	2	1	1
im. tubificids w/o hair setae	17	8	2
Limnodrilus hoffmeisteri	1	0	0
Potamathrix vejdovskyi	1	1	1
Tubifex ignotus	0	0	1
Tubifex embryos	0	3	0
sample area code	1	1	1

Table 15: Benthic invertebrate data listing for 1981, transect 15 (Newcastle), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralie	2	5	0
Oecetis inconspicua	0	0	1
Gammarus fasciatus	40	3	3
Cascidotea racovitzae	1	1	0
Chironomus spp	0	1	0
Cryptochironomus spp	2	1	0
Microtendipes spp	1	0	0
Parachironomus spp	1	0	0
Paratendipes spp	4	0	0
Phaenopsectra spp	0	2	0
Polypedilum simulans	1	0	0
Potthastia spp	1	0	0
Tanytarsus spp	3	0	0
Zavrelia spp	2	0	3
Conchopelpopia spp	3	1	1
Chaetogaster diaphanus	63	12	8
Chaetogaster diastrophus	0	1	0
Nais bretscheri	9	4	1
Nais variabilis	15	3	1
Slavina appendiculata	4	0	0
Stylaria lacustris	8	3	3
Uncinais uncinata	3	5	0
Vejdovskyella intermedia	149	38	27
im. tubifids w hair setae	19	0	1
im. tubificids w/o hair setae	47	2	5
Limnodrilus hoffmeisteri	24	1	0
Potamathrix moldaviensis	1	0	0
Potamathrix vejdovskyi	12	0	0
Tubifex ignotus	1	0	0
Tubifex tubifex	1	0	0
Tubifex embryos	32	6	2
sample area code	1	1	1

Table 16: Benthic invertebrate data listing for 1981, transect 16 (Port Hope), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralie	0	0	1
Gammarus fasciatus	0	0	5
Cladopelma spp	9	9	23
Cryptochironomus spp	7	2	1
Paracladopelma spp	0	0	1
Paracladopelma undine	0	0	2
Paraclodpelma winnelli	1	0	1
Paratendipes spp	0	1	5
Polypedilum scalaenum	7	25	20
Monodiamesa depectinata	1	0	1
Tanytarsus spp	1	0	2
Cricotopus spp	0	2	9
Cricotopus festivellus	3	0	0
Heterotriseocladius changi	10	5	15
Parakiefferiella spp	3	0	7
Ablabesmyia spp	1	0	4
Pisidium walkeri	0	0	1
Chaetogaster diaphanus	1	0	42
Chaetogaster diastrophus	0	0	3
Nais bretscheri	3	3	41
Nais elinguis	0	0	3
Nais simplex	0	1	3
Nais variabilis	7	3	36
Piguetiella michiganensis	29	0	55
Stylaria lacustris	2	0	9
Uncinais uncinata	3	0	2
Vejdovskyella intermedia	169	22	94
im. tubifids w hair setae	6	0	3
im. tubificids w/o hair setae	45	6	41
Limnodrilus hoffmeisteri	0	0	3
Potamathrix vejdovskyi	1	0	0
Tubifex embryos	28	1	19
sample area code	1	1	1

Table 17: Benthic invertebrate data listing for 1981, transect 17 (Cobourg), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralis	12	13	15
Oecetis inconspicua	3	1	1
Gammarus fasciatus	1	4	5
Cladopelma spp	2	1	3
Cryptochironomus spp	0	1	0
Dicrotendipes fumidus	4	3	11
Paratendipes spp	6	8	0
Tanytarsus spp	3	2	1
Cricotopus spp	0	3	4
Cricotopus bicinotus	0	0	3
Heterotrissocladius changi	3	2	2
Parakiefferiella spp	1	0	0
Thienemanniella spp	0	2	2
Pisidium casertanum	0	5	0
Pisidium fallax	0	1	1
Pisidium variabile	1	0	2
Stylodrilus heringianus	0	3	0
Chaetogaster diaphanus	26	35	9
Chaetogaster diastrophus	0	0	1
Nais bretscheri	8	73	18
Nais pseudobtusa	6	9	6
Nais variabilis	2	4	15
Piguetiella michiganensis	3	3	1
Stylaria lacustris	0	5	2
Uncinais uncinata	1	6	1
Vejdovskyella intermedia	33	35	29
im. tubifids w hair setae	1	2	0
im. tubificids w/o hair setae	46	43	6
Limnodrilus hoffmeisteri	3	3	0
Peloscolex curvisetosus	1	0	0
Tubifex nerthus	0	2	0
Tubifex embryos	2	6	2
sample area code	1	1	1

Table 18: Benthic invertebrate data listing for 1981, transect 18 (Presqu'ile), 5m depth. Data are for number of individuals in three replicate samples.

Oecetis spp a	1	0	2
Diaporeia spp	0	5	1
Gammarus fasciatus	27	8	12
Caecidotea racovitzae	1	4	0
Chironomus fluviatilis	2	1	0
Cladopelma spp	18	28	8
Cryptochironomus spp	1	2	2
Dicrotendipes fumidus	12	25	1
Paraclodpelma winnelli	1	3	1
Paratendipes spp	0	2	3
Polypedilum scalaenum	2	5	3
Monodiamesa spp	1	1	2
Potthastia spp	0	0	1
Paratanytarsus spp	11	2	0
Tanytarsus spp	11	5	3
Cricotopus tremulus	5	9	2
Heterotrissocladius changi	13	24	12
Orthocladius spp	0	1	0
Parakiefferiella spp	15	10	8
Psectrocladius spp	3	1	0
Pseudosmittia spp	0	2	0
Thienemanniella spp	7	5	2
Ablabesmyia spp	0	1	1
Helisoma anceps	0	0	1
Marstonia decepta	1	2	0
Aeloeoma spp	0	0	1
Enchytraeidae	0	2	2
Stylodrilus heringianus	1	4	0
Amphichaeta spp	0	0	1
Chaetogaster diaphanus	6	1	5
Nais variabilis	1	0	1
Uncinais uncinata	5	0	1
Vejdovskyella intermedia	1	5	3
im. tubifids w hair setae	0	9	1
im. tubificids w/o hair setae	5	35	3
Limnodrilus hoffmeisteri	0	2	0
Potamathrix vejdovskyi	0	4	0
Tubifex embryos	1	7	0
sample area code	1	1	1

Table 19: Benthic invertebrate data listing for 1981, transect 19 (Robinson Point), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralie	1	9	1
Ceraclea nepha	1	2	3
Gammarus fasciatus	10	10	2
Chironomus spp	1	0	0
Cladopelma spp	3	1	0
Dicrotendipes fumidus	4	2	0
Microtendipes pedellus	1	1	0
Potthastia spp	1	0	0
Tanytarsus spp	5	2	1
Cricotopus curtus	5	4	1
Cricotopus festivellus	5	0	1
Heterotrissocladius changi	2	0	0
Parakiefferiella spp	0	1	0
Psectrocladius spp	16	7	4
Thienemanniella spp	6	1	1
Ablabesmyia spp	0	2	0
Physella gyrina	1	3	2
Stagnicola emarginata	0	2	0
Chaetogaster diaphanus	26	70	23
Nais simplex	0	1	0
Slavina appendiculata	1	0	0
Vejdovskyella intermedia	0	0	1
sample area code	1	1	1

Table 20: Benthic invertebrate data listing for 1981, transect 20 (Spencer Point), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralie	1	1	0
Ceraclea nepha	1	0	0
Gammarus fasciatus	1	3	3
Cryptochironomus spp	0	1	0
Dicrotendipes fumidus	2	0	0
Tanytarsus spp	4	0	0
Cricotopus curtus	1	0	2
Psectrocladius spp	0	2	0
Thienemanniella spp	1	0	0
Ablabesmyia spp	3	0	1
Amnicola limosa	1	1	0
Bythinia tentaculata	0	2	0
Gyraulus parvus	2	1	0
Physella gyrina	3	13	4
Stagnicola emarginata	4	7	0
Chaetogaster diaphanus	55	3	6
Uncinais uncinata	3	0	0
sample area code	1	1	1

Table 21: Benthic invertebrate data listing for 1981, transect 21 (Outlet Beach), 5m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	0	1	0
Gammarus fasciatus	0	1	0
Cryptochironomus spp	2	3	0
Parachironomus spp	0	3	0
Paracladopelma nereis	1	0	0
Paratendipes spp	1	0	0
Polypedilum scalaenum	0	2	0
Monodiamesa tuberculata	2	1	0
Tanytarsus spp	1	0	0
Psectrocladius spp	0	1	0
Amnicola limosa	1	0	0
Gyraulus parvus	1	0	0
Valvata sincera	1	0	0
Sphaerium striatinum	0	1	0
Pisidium casertanum	0	4	0
Pisidium fallax	1	0	0
Pisidium henslowanum	2	3	0
Pisidium lilljeborgi	0	2	0
Pisidium nitidum	1	9	0
Pisidium variabile	5	5	0
Enchytraeidae	1	0	0
Chaetogaster diastrophus	1	0	0
Nais communis	0	1	0
Piguetiella michiganensis	28	22	0
Uncinais uncinata	7	5	4
im. tubifids w hair setae	1	1	0
im. tubificide w/o hair setae	12	11	0
Potamathrix moldaviensis	2	12	0
Tubifex embryos	3	5	0
sample area code	1	1	1

Table 22: Benthic invertebrate data listing for 1981, transect 22 (Ostrander Point), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralie	5	9	9
Ceraclea nepha	1	1	0
Lirceus lineatus	8	36	9
Gammarus fasciatus	2	8	4
Cricotopus spp	1	8	1
Cricotopus bicinctus	2	0	1
Dicrotendipes neomodestus	0	2	0
Microtendipes spp	0	8	14
Paraclodpelma winnelli	0	0	1
Tanytarsus spp	0	1	0
Cricotopus curtus	2	1	2
Parakiefferiella spp	0	0	1
Pseudosmittia spp	0	5	2
Amnicola limosa	3	2	0
Bythinia tentaculata	7	2	0
Helisoma ancepe	0	0	3
Marstonia decepta	19	89	16
Pleurocera acuta	0	2	0
Pisidium casertanum	1	13	2
Pisidium fallax	4	15	12
Pisidium henslowanum	1	5	0
Pisidium lilljeborgi	0	2	0
Pisidium nitidum	0	1	0
Pisidium puctatum	1	1	1
Pisidium variabile	1	6	0
Enchytraeidae	0	0	1
Stylodrilus heringianus	2	0	3
Chaetogaster diaphanus	1	3	5
Vejdovskyella intermedia	2	17	5
im. tubificids w/o hair setae	0	0	1
Sparganophilus eiseni	0	1	2
sample area code	1	1	1

Table 23: Benthic invertebrate data listing for 1981, transect 23 (Prince Edward Point), 5m depth. Data are for number of individuals in three replicate samples.

Ceraclea nepha	0	4	3
Oecetis inconspicua	10	4	0
Gammarus fasciatus	10	0	5
Caecidotea racovitzae	18	8	25
Cladopelma spp	0	0	1
Microtendipes spp	0	7	14
Paratendipes spp	6	4	1
Phaenopsectra spp	0	1	0
Stictochironomus spp	0	0	2
Micropsectra spp	0	2	0
Tanytarsus spp	4	1	3
Cricotopus curtus	0	1	0
Ablabesmyia spp	0	0	1
Amnicola limosa	4	0	2
Bythinia tentaculata	116	9	49
Cincinnatia cincinnatiensis	4	1	0
Gyraulus parvus	0	0	2
Helisoma anceps	0	1	0
Physella gyrina	16	2	4
Stagnicola emarginata	2	0	0
Valvata lewisi	0	1	0
Valvata tricarinata	14	2	3
Musculium partumeium	4	0	1
Sphaerium nitidum	8	15	10
Pisidium casertanum	8	4	1
Pisidium fallax	4	3	1
Pisidium henslowanum	6	0	0
Pisidium idahoense	8	0	0
Pisidium lilljeborgi	8	8	9
Pisidium nitidum	6	3	1
Pisidium rotundatum	0	1	0
Pisidium subtruncatum	0	1	0
Pisidium variabile	32	8	17
Oligochaeta	523	362	380
Enchytraeidae	4	0	0
Stylodrilus heringianus	0	1	0
Chaetogaster diaphanus	26	2	9
Vejdovskyella intermedia	36	10	50
im. tubifids w hair setae	10	8	3
im. tubificids w/o hair setae	1041	328	410
Potamathrix moldaviensis	10	1	5
Potamathrix vejdovskyi	2	14	30
Tubifex embryos	12	0	20
sample area code	1	1	1

Table 24: Benthic invertebrate data listing for 1981, transect 24 (Prince Edward Bay), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralie	4	4	10
Oecetis inconspicua	1	0	2
Limnephilus spp	1	0	0
Gammarus fasciatus	3	2	0
Hyalella azteca	5	11	4
Caecidotea racovitzae	20	21	5
Pseudochironomus spp	0	0	1
Procladius spp	0	1	0
Amnicola limosa	4	54	36
Bythinia tentaculata	79	75	68
Cincinnatia cincinnatiensis	0	6	0
Gyraulus parvus	0	0	2
Helisoma anceps	1	0	0
Physella gyrina	1	0	3
Pleurocera acuta	0	1	0
Promenetus exacuus	0	1	0
Valvata sincera	0	6	13
Valvata tricarinata	1	13	26
Sphaerium nitidum	20	26	4
Pisidium casertanum	1	2	0
Pisidium compressum	0	1	0
Pisidium ferrugineum	6	3	3
Pisidium idahoensis	1	0	0
Pisidium lilljeborgi	3	0	0
Pisidium nitidum	2	0	0
Pisidium rotundatum	0	0	3
Pisidium subtruncatum	0	0	1
Pisidium variabile	1	0	0
Lumbriculus variegatus	0	1	0
Chaetogaster diaphanus	1	1	0
Chaetogaster diastrophus	0	0	1
Vejdovskyella intermedia	1	0	0
Potamathrix vejdovskyi	1	2	0
Sparganophilus eiseni	1	1	0
Stylaria lacustris	1	0	0
sample area code	1	1	1

Table 25: Benthic invertebrate data listing for 1981, transect 25 (Amherst Island), 5m depth. Data are for number of individuals in three replicate samples.

Oecetis inconspicua	2	0	0
Hydroptilla	0	1	0
Gammarus fasciatus	57	19	34
Caecidotea racovitzae	4	5	9
Cladopelma spp	0	0	1
Dicrotendipes fumidus	1	0	0
Microtendipes spp	7	1	2
Pseudosmittia spp	1	0	0
Amnicola limosa	2	9	4
Bythinia tentaculata	42	18	6
Cincinnatia cincinnatiensis	2	1	0
Gyraulus parvus	1	0	0
Physella gyrina	6	0	4
Pleurocera acuta	3	8	4
Stagnicola emarginata	79	15	15
Valvata sincera	0	1	0
Sphaerium nitidum	1	2	6
Pisidium henslowanum	0	0	1
Enchytraeidae	0	0	1
Chaetogaster diaphanus	21	1	4
Nais pardalis	2	0	0
Stylaria lacustris	1	5	3
Vejdovskyella intermedia	0	0	1
sample area code	1	1	1

DATA APPENDIX
LAKE ONTARIO BENTHIC INVERTEBRATES
1981 AND 1991 COMPARISON

Results for:

1981, 20m depth

- numbers per sample
- sample area was 78 cm^{-2} (sample area code 1)
- lower size limit was 200 um

NOTE: 1) No data for transect 11.
2) n=2 for transect 21.

Table 1: Benthic invertebrate data listing for 1981, transect 1 (Niagara-on-the-lake), 20m depth. Data are for number of individuals in three replicate samples.

Prostoma graecense	0	0	3
Diaporeia spp	90	60	18
Caecidotea racovitzae	2	2	1
Paracladopelma spp	0	1	0
Tanytarsus spp	67	17	10
Heterotrissocladius spp	7	0	1
Procladius spp	23	10	3
Sphaerium nitidum	12	5	1
Pisidium casertanum	6	2	30
Pisidium conventus	4	22	13
Pisidium henelowanum	2	7	8
Pisidium lilljeborgi	6	5	10
Pisidium subtruncatum	2	4	3
Pisidium variabile	16	19	15
Pisidium walkeri	1	3	0
Stylodrilus heringianus	0	1	0
Amphichaeta spp	0	0	1
Vejdovskyella intermedia	40	17	29
im. tubifids w hair setae	27	12	0
im. tubificids w/o hair setae	83	37	14
Limnodrilus hoffmeisteri	3	3	1
Limnodrilus udekemianus	0	2	0
Peloscolex ferox	60	41	3
Potamathrix moldaviensis	17	12	0
Potamathrix vejdovskyi	63	36	19
Tubifex tubifex	3	0	0
Tubifex embryos	227	21	3
sample area code	1	1	1

Table 2: Benthic invertebrate data listing for 1981, transect 2 (Port Dalhousie), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	25	61	26
Caecidotea racovitzae	3	12	4
Lepidostoma spp	3	0	0
Monodiamesa spp	1	0	0
Tanytarsus spp	0	2	1
Procladius spp	8	8	6
Muculium transversum	1	0	0
Pisidium casertanum	0	0	3
Pisidium conventus	4	5	2
Pisidium henslowanum	8	8	1
Pisidium subtruncatum	0	0	1
Pisidium variabile	14	20	2
Pisidium lilljeborgi	0	0	2
Stylodrilus heringianus	3	14	5
Slavina appendiculata	0	0	1
Vejdovskyella intermedia	28	14	0
im. tubificids w/o hair setae	43	85	18
Limnodrilus hoffmeisteri	1	3	0
Peloscolex ferox	19	63	20
Potamathrix moldaviensis	8	7	0
Potamathrix vejdovskyi	29	37	19
Tubifex ignotus	1	7	0
Tubifex tubifex	1	10	0
sample area code	1	1	1

Table 3: Benthic invertebrate data listing for 1981, transect 3 (Jordan Harbour), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	21	18	84
Caecidotea racovitzae	20	3	9
Lepidostoma spp	0	0	1
Parachironomus spp	1	0	0
Paracladopelma spp	1	0	2
Monodiamesa spp	0	0	1
Tanytarsus spp	101	144	28
Cricotopus spp	1	0	1
Heterotrissocladius changi	0	7	78
Heterotrissocladius oliveri	0	1	5
Procladius spp	3	12	6
Physella gyrina	3	3	0
Valvata sincera	10	13	0
Musculium partumeium	0	2	0
Sphaerium nitidum	8	28	0
Pisidium casertanum	2	11	0
Pisidium conventus	33	5	0
Pisidium lilljeborgi	16	15	0
Pisidium variabile	21	35	0
Pisidium walkeri	1	0	0
Manayunkia speciosa	0	0	3
Oligochaeta	0	209	0
Enchytraeidae	0	0	1
Stylodrilus heringianus	1	47	36
Chaetogaster diaphanus	60	3	0
Nais variabilis	0	0	1
Slavina appendiculata	1	0	1
Stylaria lacustris	22	4	1
Vejdovskyella intermedia	102	73	93
im. tubificids w/o hair setae	1	0	41
Limnodrilus hoffmeisteri	0	0	4
Peloscolex ferox	0	2	3
Potamathrix moldaviensis	0	0	1
Potamathrix vejdovskyi	0	0	18
Tubifex embryos	6	16	5
sample area code	1	1	1

Table 4: Benthic invertebrate data listing for 1981, transect 4 (Beamsville), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	0	0	3
Caecidotea racovitzae	0	2	10
Chironomus anthracinus	0	1	0
Micropsectra spp	1	0	0
Tanytarsus spp	1	5	1
Cricotopus spp	0	3	0
Beterotrissocladius spp	0	5	0
Procladius spp	0	1	0
Gyraulus parvus	0	0	1
Belisoma anceps	0	1	0
Valvata lewisi	1	2	0
Valvata sincera	1	4	0
Sphaerium nitidum	0	3	0
Pisidium casertanum	0	1	0
Pisidium conventus	1	4	0
Pisidium ferrugineum	0	0	1
Chaetogaster diaphanus	6	0	1
Chaetogaster diastrophus	1	1	0
Vejdovskyella intermedia	21	196	44
im. tubifids w hair setae	0	0	1
im. tubificids w/o hair setae	1	2	2
Potamathrix vejdovskyi	1	2	0
Peloscolex ferox	2	0	0
Tubifex embryoe	1	2	0
sample area code	1	1	1

Table 5: Benthic invertebrate data listing for 1981, transect 5 (Stoney Creek), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	158	208	196
Caecidotea racovitzae	0	68	0
Chironomus fluviatilis	0	0	1
Tanytarsus spp	2	0	1
Heterotrissocladius spp	4	0	2
Pisidium casertanum	10	8	4
Pisidium conventus	6	10	2
Pisidium variabile	28	48	14
Stylodrilus heringianus	26	20	38
Vejdovskyella intermedia	6	4	9
im. tubifids w hair setae	48	62	17
Limnodrilus hoffmeisteri	10	6	9
Potamathrix vejdovskyi	40	12	29
Tubifex ignotus	6	0	0
Tubifex tubifex	0	2	0
Tubifex embryos	4	2	11
sample area code	1	1	1

Table 6: Benthic invertebrate data listing for 1981, transect 6 (Hamilton Beach), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	42	62	68
Caecidotea racovitzae	4	2	4
Tanytarsus spp	2	2	2
Heterotrissocladius spp	0	0	2
Procladius spp	10	4	10
Sphaerium nitidum	0	2	4
Pisidium casertanum	4	10	10
Pisidium conventus	6	0	12
Pisidium henslowanum	2	0	2
Pisidium lilljeborgi	8	2	2
Pisidium nitidum	0	0	8
Pisidium subtruncatum	2	0	2
Pisidium variabile	26	0	2
Pisidium ventricosum	2	0	0
Stylodrilus heringianus	32	22	18
Vejdovskyella intermedia	50	4	14
im. tubifids w hair setae	8	12	6
im. tubificids w/o hair setae	116	70	88
Limnodrilus hoffmeisteri	8	4	2
Peloscolex ferox	0	2	0
Potamathrix moldaviensis	20	20	2
Potamathrix vejdovskyi	30	34	38
Tubifex embryos	8	6	20
sample area code	1	1	1

Table 7: Benthic invertebrate data listing for 1981, transect 7 (Bronte), 20m depth. Data are for number of individuals in three replicate samples.

Prostoma graecense	1	0	0
Diaporeia spp	19	4	1
Gammarus fasciatus	0	0	1
Caecidotea racovitzae	0	3	3
Cryptochironomus spp	0	1	0
Parachironomus spp	0	1	2
Cricotopus spp	0	0	2
Heterotrissocladius changi	28	12	5
Heterotrissocladius oliveri	2	1	0
Thienemanniella spp	0	0	1
Procladius spp	19	4	2
Gyraulus parvus	1	0	0
Physella gyrina	0	2	0
Valvata sincera	2	2	5
Pisidium conventus	1	0	3
Stylodrilus heringianus	7	2	2
Chaetogaster diaphanus	0	1	24
Chaetogaster diastrophus	7	0	1
Nais variabilis	0	1	0
Stylaria lacustris	5	0	3
Vejdovskyella intermedia	152	223	358
im. tubifids w hair setae	8	1	3
im. tubificids w/o hair setae	15	1	1
Aulodrilus pluriseta	0	1	1
Limnodrilus hoffmeisteri	2	0	0
Peloscolex ferox	1	1	1
Potamathrix moldaviensis	45	6	9
Tubifex embryos	8	5	0
sample area code	1	1	1

Table 8: Benthic invertebrate data listing for 1981, transect 8 (Oakville), 20m depth. Data are for number of individuals in three replicate samples.

Caenis spp	0	1	0
Prostoma graecense	0	0	1
Chironomus anthracinus	1	0	0
Parachironomus spp	0	0	2
Heterotrissocladius spp	0	0	1
Heterotrissocladius changi	0	0	1
Heterotrissocladius oliveri	0	0	2
Psectrocladius spp	1	0	0
Procladius spp	16	0	4
Physella gyrina	0	2	0
Valvata sincera	0	1	0
Pisidium casertanum	35	0	12
Pisidium compressum	1	0	0
Pisidium conventus	8	5	8
Pisidium henslowanum	1	0	0
Pisidium lilljeborgi	3	3	1
Pisidium subtruncatum	1	0	0
Pisidium variabile	1	1	2
Aelosoma spp	0	0	1
Stylodrilus heringianus	0	0	1
Amphichaeta spp	20	0	0
Chaetogaster diaphanus	0	9	0
Stylaria lacustris	0	2	0
Vejdovskyella intermedia	215	138	538
im. tubifids w hair setae	405	121	180
im. tubificids w/o hair setae	467	205	269
Aulodrilus pluriseta	10	0	0
Limnodrilus hoffmeisteri	30	0	4
Limnodrilus profundicola	10	0	0
Peloscolex ferox	9	6	8
Peloscolex multisetosus	0	1	0
Potamathrix moldaviensis	1	0	0
Potamathrix vejdovskyi	81	17	69
Tubifex kesleri	2	3	0
Tubifex embryos	47	4	21
sample area code	1	1	1

Table 9: Benthic invertebrate data listing for 1981, transect 9 (Etobicoke), 20m depth. Data are for number of individuals in three replicate samples.

Caecidotea racovitzae	0	1	0
Dicrotendipes fumidus	0	0	1
Tanytarsus spp	0	0	1
Procladius spp	0	1	0
Helisoma anceps	0	0	1
Physella gyrina	1	0	4
Valvata sincera	9	0	11
Pisidium casertanum	2	0	14
Pisidium conventus	4	0	8
Pisidium henslowanum	0	0	1
Pisidium lilljeborgi	1	0	8
Pisidium nitidum	1	0	0
Chaetogaster diaphanus	0	0	3
Vejdovskyella intermedia	20	4	137
im. tubifids w hair setae	1	0	1
im. tubificids w/o hair setae	1	1	3
Peloscolex ferox	2	3	4
Potamathrix vejdovskyi	0	1	0
sample area code	1	1	1

Table 10: Benthic invertebrate data listing for 1981, transect 10 (Humber Bay), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	30	5	36
Caecidotea racovitzae	1	0	1
Monodiamesa tuberculata	0	1	0
Procladius spp	4	0	11
Pisidium casertanum	5	6	4
Pisidium henslowanum	1	2	1
Pisidium subtruncatum	4	1	1
Oligochaeta	552	204	801
Chaetogaster diaphanus	3	0	0
Nais variabilis	5	2	0
Vejdovskyella intermedia	96	3	7
im. tubifids w hair setae	337	136	695
im. tubificids w/o hair setae	149	48	89
Aulodrilus pluriseta	0	2	0
Limnodrilus hoffmeisteri	0	0	4
Peloscolex ferox	43	13	18
Peloscolex multisetosus	3	0	0
Potamathrix vejdovskyi	55	16	25
Tubifex embryos	46	13	58
sample area code	1	1	1

Table 12: Benthic invertebrate data listing for 1981, transect 12 (Birch Cliff), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	144	220	157
Cladopelma spp	0	1	0
Heterotrissocladius oliveri	0	0	1
Pisidium casertanum	0	2	0
Enchytraeidae	7	12	4
Stylodrilus heringianus	40	67	31
Chaetogaster diaphanus	2	6	2
Nais elinguis	1	0	1
Nais variabilis	0	0	1
Vejdovskyella intermedia	10	42	7
im. tubifide w hair setae	0	1	0
im. tubificids w/o hair setae	1	1	0
Tubifex embryos	3	2	3
sample area code	1	1	1

Table 13: Benthic invertebrate data listing for 1981, transect 13 (Guildwood), 20m depth. Data are for number of individuals in three replicate samples.

Prostoma graecense	2	1	2
Cladopelma spp	0	1	3
Cricotopus spp	0	1	1
Heterotrissocladius oliveri	1	0	1
Pisidium casertanum	5	9	1
Pisidium conventus	7	10	3
Pisidium lilljeborgi	3	3	1
Pisidium variabile	2	1	0
Stylodrilus heringianus	0	1	0
Chaetogaster diaphanue	0	0	2
Chaetogaster diastrophus	1	0	4
Nais variabilis	0	1	0
Slavina appendiculata	2	0	0
Vejdovskyella intermedia	54	74	63
im. tubificids w/o hair setae	8	2	0
Potamathrix vejdovskyi	2	6	0
Tubifex embryos	1	0	0
sample area code	1	1	1

Table 14: Benthic invertebrate data listing for 1981, transect 14 (Whitby), 20m depth. Data are for number of individuals in three replicate samples.

Hydroptila	0	0	1
Caecidotea racovitzae	0	3	2
Cladopelma spp	2	2	2
Endochironomus spp	1	0	0
Paraclodpelma winnelli	1	0	0
Paratanytarsus spp	0	1	0
Tanytarsus spp	4	0	1
Zavrelia spp	0	0	1
Larsia spp	1	0	1
Stylodrilus heringianus	0	4	1
Chaetogaster diaphanus	1	4	3
Chaetogaster diastrophus	0	0	2
Slavina appendiculata	0	6	1
Stylaria lacustris	0	0	5
Vejdovskyella intermedia	151	95	28
im. tubifids w hair setae	4	4	2
im. tubificids w/o hair setae	2	3	3
Limnodrilus hoffmeisteri	1	0	0
Potamathrix vejdovskyi	8	0	9
Tubifex embryos	1	0	1
sample area code	1	1	1

Table 15: Benthic invertebrate data listing for 1981, transect 15 (Newcastle), 20m depth. Data are for number of individuals in three replicate samples.

Cladopelma spp	4	3	0
Dicrotendipes neomodestus	0	1	0
Zavrelia spp	1	6	0
Ablabesmyia spp	1	0	0
Procladius spp	0	1	0
Pisidium casertanum	0	22	5
Pisidium conventus	2	19	4
Pisidium lilljeborgi	0	15	3
Pisidium variabile	0	0	1
Pisidium walkeri	0	1	0
Enchytraeidae	1	0	0
Stylodrilus heringianus	1	0	0
Slavina appendiculata	0	1	0
Vejdovskyella intermedia	20	118	1
im. tubifids w hair setae	4	0	2
im. tubificids w/o hair setae	3	0	2
Potamathrix vejdovskyi	13	1	0
Tubifex embryos	0	3	0
sample area code	1	1	1

Table 16: Benthic invertebrate data listing for 1981, transect 16 (Port Hope), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	0	1	0
Dicrotendipes neomodestus	0	0	1
Paracladopelma nais	1	0	0
Paratendipes spp	1	0	0
Polypedilum laetum	11	2	5
Tanytarsus spp	2	3	3
Zavrelia spp	21	17	11
Cricotopus spp	1	1	1
Heterotrissocladius spp	0	0	1
Ablabesmyia spp	1	0	1
Sphaerium nitidum	2	2	1
Sphaerium striatinum	1	0	0
Pisidium casertanum	4	7	1
Pisidium conventus	2	3	5
Pisidium fallax	2	2	0
Pisidium lilljeborgi	0	4	5
Pisidium nitidum	2	0	0
Pisidium subtruncatum	0	0	1
Pisidium variabile	0	0	4
Enchytraeidae	4	0	0
Stylodrilus heringianus	12	0	3
Chaetogaster diaphanus	3	7	10
Nais variabilis	0	0	1
Slavina appendiculata	1	2	4
Vejdovskyella intermedia	422	238	235
im. tubifids w hair setae	18	2	15
im. tubificids w/o hair setae	5	2	1
Limnodrilus hoffmeisteri	4	0	2
Peloscolex ferox	1	1	1
Peloscolex superiorensis	2	0	3
Potamathrix vejdovskyi	6	3	7
Tubifex embryos	13	0	2
sample area code	1	1	1

Table 17: Benthic invertebrate data listing for 1981, transect 17 (Cobourg), 20m depth. Data are for number of individuals in three replicate samples.

Cladopelma spp	0	0	1
Stempellinella spp	1	0	0
Tanytarsus spp	0	0	37
Zavrelia spp	0	1	3
Heterotrissocladius changi	0	1	0
Ablabesmyia spp	0	1	1
Gyraulus parvus	1	4	0
Helisoma anceps	4	0	0
Physella gyrina	1	1	0
Stagnicola emarginata	1	0	0
Sphaerium nitidum	2	1	2
Pisidium casertanum	0	0	4
Pisidium conventus	2	1	2
Pisidium henslowanum	0	0	1
Pisidium lilljeborgi	1	0	1
Pisidium variabile	5	1	5
Stylodrilus heringianus	0	0	3
Vejdovskyella intermedia	17	6	17
im. tubificids w/o hair setae	0	0	2
Potamathrix vejdovskyi	1	0	0
Tubifex embryos	0	0	1
sample area code	1	1	1

Table 18: Benthic invertebrate data listing for 1981, transect 18 (Presqu'ile), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	46	10	57
Polypedilum laetum	1	1	1
Tanytarsus spp	2	0	0
Physella gyrina	0	0	1
Pisidium casertanum	1	0	7
Pisidium conventus	0	0	2
Pisidium henslowanum	1	0	1
Pisidium lilljeborgi	0	0	2
Pisidium variabile	2	0	3
Stylodrilus heringianus	6	4	9
Chaetogaster diaphanus	5	2	3
Piguetiella michiganensis	1	0	0
Vejdovskyella intermedia	1	0	0
im. tubificide w/o hair setae	4	1	5
sample area code	1	1	1

Table 19: Benthic invertebrate data listing for 1981, transect 19 (Robinson Point), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	21	17	9
Cryptochironomus spp	1	1	1
Polypedilum laetum	2	0	2
Tanytarsus spp	9	4	49
Heterotrissocladius changi	1	1	0
Psectrocladius spp	1	0	0
Pisidium conventus	0	1	0
Pisidium variabile	3	0	0
Stylodrilus heringianus	4	0	4
Uncinais uncinata	0	1	0
Vejdovskyella intermedia	0	5	0
im. tubifids w hair setae	1	5	0
im. tubificids w/o hair setae	4	17	3
Peloscolex superiorensis	0	2	0
Tubifex embryos	3	2	0
sample area code	1	1	1

Table 20: Benthic invertebrate data listing for 1981, transect 20 (Spencer Point), 20m depth. Data are for number of individuals in three replicate samples.

Prostoma graecense	1	1	0
Diaporeia spp	9	14	35
Gammarus fasciatus	0	1	0
Tanytarsus spp	0	1	3
Stagnicola emarginata	0	0	1
Valvata sincera	0	0	1
Sphaerium nitidum	1	1	11
Pisidium casertanum	0	0	20
Pisidium conventus	0	2	0
Pisidium ferrugineum	0	0	1
Pisidium henslowanum	0	2	20
Pisidium lilljeborgi	0	7	7
Pisidium nitidum	1	2	11
Pisidium variabile	0	1	12
Stylodrilus heringianus	3	40	43
Chaetogaster diaphanus	0	2	12
Vejdovskyella intermedia	9	11	27
im. tubifids w hair setae	0	3	1
im. tubificids w/o hair setae	3	7	5
Limnodrilus hoffmeisteri	0	0	3
Peloscolex ferox	0	2	0
Potamathrix vejdovskyi	0	5	13
Tubifex embryos	2	4	3
Sparganophilus eiseni	1	0	0
sample area code	1	1	1

Table 21: Benthic invertebrate data listing for 1981, transect 21 (Outlet Beach), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	195	154
Tanytarsus spp	0	1
Procladius spp	1	0
Sphaerium nitidum	4	4
Pisidium casertanum	29	30
Pisidium henslowanum	18	11
Pisidium lilljeborgi	3	4
Pisidium nitidum	2	2
Pisidium puctatum	0	1
Pisidium rotundatum	1	0
Pisidium variabile	6	9
Stylodrilus heringianus	123	113
Chaetogaster diaphanus	10	11
Vejdovskyella intermedia	83	147
im. tubifids w hair setae	7	8
im. tubificids w/o hair setae	56	27
Limnodrilus hoffmeisteri	2	2
Peloscolex ferox	20	15
Potamathrix vejdovskyi	11	5
Tubifex embryos	5	2
sample area code	1	1

Table 22: Benthic invertebrate data listing for 1981, transect 22 (Ostrander Point), 20m depth. Data are for number of individuals in three replicate samples.

Phylocentropus spp	2	0	0
Diaporeia spp	2	0	0
Gammarus fasciatus	2	0	0
Micropsectra spp	0	4	0
Procladius	2	0	6
Paratanytarsus spp	2	0	0
Tanytarsus spp	6	120	14
Ablabesmyia spp	2	0	0
Valvata sincera	4	2	0
Valvata tricarinata	0	2	0
Sphaerium nitidum	2	0	2
Pisidium casertanum	26	16	8
Pisidium henslowanum	8	0	4
Pisidium lilljeborgi	6	0	2
Pisidium rotundatum	0	4	2
Pisidium variabile	2	0	0
Chaetogaster diaphanus	6	0	10
Slavina appendiculata	6	0	6
Specaria josinae	10	8	2
Stylaria lacustris	4	0	2
Vejdovskyella intermedia	110	48	112
im. tubifids w hair setae	20	4	2
im. tubificids w/o hair setae	36	112	36
Aulodrilus limnobius	20	0	0
Aulodrilus pluriseta	6	0	0
Limnodrilus hoffmeisteri	16	8	2
Peloscolex superiorensis	4	8	0
Peloscolex ferox	20	32	14
Potamathrix vejdovskyi	26	12	6
Tubifex embryos	0	4	0
sample area code	1	1	1

Table 23: Benthic invertebrate data listing for 1981, transect 23 (Prince Edward Point), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	16	0	23
Gammarus fasciatus	4	1	1
Caecidotea racovitzae	0	6	18
Paratendipes spp	0	1	0
Procladius	6	0	11
Polypedilum trigonum	0	3	0
Tanytarsus spp	0	0	5
Sphaerium nitidum	10	1	8
Pisidium casertanum	20	2	3
Pisidium conventus	2	0	0
Pisidium ferrugineum	0	0	1
Pisidium lilljeborgi	6	3	10
Pisidium nitidum	0	1	2
Pisidium rotundatum	0	1	0
Pisidium subtruncatum	0	0	1
Pisidium variabile	0	3	7
Pisidium ventricosum	2	1	6
Pisidium walkeri	1	4	0
Oligochaeta	0	0	85
Slavina appendiculata	0	1	6
Vejdovskyella intermedia	70	7	126
im. tubifids w hair setae	26	10	39
im. tubificids w/o hair setae	6	1	5
Aulodrilus pluriseta	126	65	123
Peloscolex ferox	36	42	54
Potamathrix vejdovskyi	6	11	9
Tubifex embryos	4	0	3
sample area code	1	1	1

Table 24: Benthic invertebrate data listing for 1981, transect 24 (Prince Edward Bay), 20m depth. Data are for number of individuale in three replicate samples.

Mystacides sepulchralis	0	2	0
Lirceus lineatus	0	2	0
Diaporeia spp	1	2	23
Gammarus fasciatus	0	24	0
Caecidotea racovitzae	0	26	1
Chironomus salinarius	0	0	1
Chironomus semireductus	1	0	0
Paratendipes spp	0	1	0
Tanytarsue spp	0	0	2
Procladius spp	2	9	19
Amnicola limosa	0	2	0
Bythinia tentaculata	0	28	0
Valvata sincera	0	3	0
Valvata tricarinata	0	2	0
Sphaerium nitidum	0	21	1
Sphaerium simile	0	0	1
Sphaerium striatinum	0	0	6
Pisidium casertanum	4	8	0
Pisidium ferrugineam	0	2	1
Pisidium henslowanum	0	4	0
Pisidium lilljeborgi	0	0	3
Pisidium variabile	0	0	2
Specaria josinae	0	0	2
Stylaria lacustris	1	2	0
Vejdovskyella intermedia	0	0	12
im. tubifids w hair setae	6	9	20
im. tubificids w/o hair setae	0	3	5
Aulodrilus limnobius	0	0	1
Aulodrilus pluriseta	0	0	9
Limnodrilus hoffmeisteri	1	0	0
Peloscolex ferox	1	1	0
sample area code	1	1	1

Table 25: Benthic invertebrate data listing for 1981, transect 25 (Amherst Island), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	28	4	0
Gammarus fasciatus	4	0	0
Caecidotea racovitzae	8	0	1
Chironomus plumoeus	1	0	0
Chironomus semireductus	0	1	0
Procladius	10	1	2
Stictochironomus spp	1	0	1
Tanytarsus spp	1	0	0
Anodonta grandis	1	0	0
Sphaerium nitidum	0	0	8
Pisidium casertanum	8	0	2
Pisidium dubium	8	4	0
Pisidium henslowanum	4	4	0
im. tubifids w hair setae	4	2	1
im. tubificids w/o hair setae	66	54	28
Peloscolex ferox	6	1	1
sample area code	1	1	1

DATA APPENDIX
LAKE ONTARIO BENTHIC INVERTEBRATES
1981 AND 1991 COMPARISON

Results for:

1991, 5m depth

- numbers per sample
- sample areas were:
  - 78 cm^2 (sample area code 1)
  - 929 cm^2 (sample area code 2)
  - 625 cm^2 (sample area code 3)

- lower size limit was 200 um

Table 1: Benthic invertebrate data listing for 1991, transect 1 (Niagara-on-the-lake), 5m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	0	12	0
Cura foremanii	0	8	0
Gammarus fasciatus	692	680	728
Cricotopus curtus	4	0	0
Psectrocladius simulans	8	8	0
Procladius spp	4	0	0
Bythinia tentaculata	0	0	4
Gyraulus parvus	8	8	4
Helisoma anceps	16	16	8
Physella gyrina	164	192	12
Pleurocera acuta	100	176	72
Dreissena polymorpha	48	24	4
Sphaerium striatinum	4	0	0
Pisidium compressum	12	0	0
Stylodrilus heringianus	0	4	0
Stylaria lacustris	84	40	131.47
Vejdovskyella intermedia	4	0	4.53
im. tubificids w/o hair setae	4	0	0
sample area code	1	1	1

Table 2: Benthic invertebrate data listing for 1991, transect 2 (Port Dalhousie), 5m depth. Data are for number of individuals in three replicate samples.

Hydroptila spp	0	0	5.33
Hygrobates spp	0	0	1.33
Gammarus fasciatus	48	32	20
Chironomus spp	8	2.67	0
Chironomus anthracinus	0	1.33	4
Chironomus salinarius	0	1.33	0
Cryptochironomus spp	0	0	1.33
Paralauterborniella nigrohalterales	24	2.67	4
Polypedilum spp	4	0	1.33
Tribelos jaoundum	0	0	1.33
Tanytarsus spp	36	8	10.67
Cricotopus bicinotus	4	0	0
Cricotopus curtus	0	0	4
Heterotrissocladius changi	4	1.33	2.67
Psectrocladius simulans	8	10.67	20
Ablabesmyia monilis	0	1.33	0
Conchopelpopia spp	0	1.33	0
Procladius spp	12	2.67	5.33
Amnicola limosa	0	3.9	14.3
Bythinia tentaculata	0	1.3	0
Gyraulus deflectus	8	3.9	0
Marstonia decepta	0	0	1.3
Physella gyrina	0	26	31.2
Physella integra	60	0	0
Pleurocera acuta	12	3.9	5.2
Probythinella lacustris	0	0	1.3
Stagnicola catascopium	0	0	1.3
Valvata sincera	4	0	0
Dreissena polymorpha	496	117	31.2
Sphaerium nitidum	4	0	0
Pisidium casertanum	8	0	1.3
Pisidium lilljeborgi	4	0	0
Pisidium subtruncatum	0	0	1.3
Nais communis	0	2.61	0
Nais pseudobtusa	8.64	0	5.09
Nais variabilis	8.64	2.61	0
Stylaria lacustris	86.4	18.29	116.99
Uncinais uncinata	0	0	5.09
im. tubifids w hair setae	34.56	10.45	0
im. tubificids w/o hair setae	241.92	67.95	61.04
Aulodrilus pigueti	0	0	15.26
Aulodrilus pluriseta	34.56	13.07	61.04
Limnodrilus hoffmeisteri	0	2.61	5.09
Potamathrix moldaviensis	0	2.61	0
Potamathrix vejdovskyi	0	5.23	5.09
Spirosperma ferox	17.28	5.23	0
sample area code	2	2	2

Table 3: Benthic invertebrate data listing for 1991, transect 3 (Jordan Harbour), 5m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	0	24	5.33
Lebertia spp	2	0	0
Piona spp	0	0	9.33
Hydrozetes spp	0	8	0
Hydrolimax grissue	0	52	14.67
Cura foremanii	28	96	34.67
Gammarus fasciatus	104	396	137.33
Hyalella azteca	2	0	2.67
Orconectes propinquus	2	0	1.33
Paratendipes albimanus	2	0	0
Polypedilum spp	0	0	1.33
Tanytarsus spp	0	0	1.33
Procladius spp	2	0	1.33
Amnicola limosa	24	96	24
Bythinia tentaculata	8	8	12
Gyraulus deflectus	14	0	2
Gyraulus parvus	0	0	4
Helisoma anceps	6	8	6
Marstonia decepta	0	0	4
Physella gyrina	58	0	60
Physella integra	0	64	0
Pleurocera acuta	88	88	112
Probythinella lacustris	0	40	0
Valvata tricarinata	66	60	52
Dreissena polymorpha	8	16	28
Sphaerium nitidum	10	8	2
Sphaerium striatinum	2	4	0
Pisidium casertanum	2	0	6
Pisidium fallax	2	4	8
Pisidium henslowanum	2	0	0
Pisidium nitidum	2	0	0
Pisidium puctatum	0	3	0
Manayunkia speciosa	0	0	2.67
Stylodrilus heringianus	2	0	2.67
Slavina appendiculata	0	4.48	0
Stylaria lacustris	66	192.64	109.33
im. tubifids w hair setae	0	0	2.67
im. tubificids w/o hair setae	6	0	5.33
Aulodrilus pluriseta	0	4.48	0
Spirosperma ferox	2	22.4	16
sample area code	2	2	2

Table 4: Benthic invertebrate data listing for 1991, transect 4 (Beamsville), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides spp	0	4	0
Hygrobates spp	0	4	20
Cura foremanii	116	72	144
Gammarus fasciatus	144	128	360
Orconectes propinquus	4	0	4
Chironomus salinarius	4	0	0
Procladius spp	4	0	0
Amnicola limosa	168	188	276
Bythinia tentaculata	12	28	0
Fossaria obrussa	0	12	0
Gyraulus parvus	0	0	8
Helisoma anceps	12	8	2
Physella gyrina	12	8	24
Pleurocera acuta	28	40	56
Probythinella lacustris	48	144	104
Valvata sincera	0	0	4
Valvata tricarinata	80	20	80
Dreissena polymorpha	12	16	0
Lasmigona complanata	0	0	1
Sphaerium nitidum	24	12	24
Sphaerium striatinum	12	20	20
Pisidium casertanum	16	48	16
Pisidium compressum	8	0	0
Pisidium fallax	12	24	16
Pisidium henslowanum	12	16	12
Pisidium lilljeborgi	0	8	8
Pisidium nitidum	16	12	4
Pisidium puctatum	0	0	1
Pisidium subtruncatum	8	0	0
Manayunkia speciosa	6.88	0	0
Stylodrilue heringianus	20.64	8	0
Stylaria lacustris	6.88	4	16
im. tubificide w/o hair setae	6.88	0	20
Potamathrix vejdovskyi	0	0	4
Spirosperma ferox	302.72	112	28
sample area code	2	2	2

Table 5: Benthic invertebrate data listing for 1991, transect 5 (Stoney Creek), 5m depth. Data are for number of individuals in three replicate samples.

Cernotina spp	0	5.33	4
Hydroptila spp	0	0	2
Mystacides spp	5.33	10.67	2
Oecetis spp	0	2.67	2
Aturus spp	0	1.33	2
Hygrobates spp	2.67	33.33	26
Lebertia spp	1.33	1.33	2
Piona spp	4	0	0
Torrenticola spp	0	2.67	2
Hydrozetes spp	0	2.67	2
Porohmannella spp	0	5.33	2
Cura foremanii	4	21.33	20
Gammarus fasciatus	40	48	46
Hyalella azteca	21.33	32	2
Orconectes juveniles	0	2.67	0
Orconectes propinquus	1.33	0	0
Caecidotea spp	0	4	2
Chironomini early instar	0	0	2
Chironomus anthracinus	1.33	0	2
Dicrotendipes fumidus	1.33	2.67	2
Parachironomus spp	0	1.33	2
Paralauterborniella nigrohalterales	1.33	0	0
Paratendipes spp	0	1.3	0
Paratendipes albimanus	0	0	2
Stictochironomus spp	0	1.33	0
Potthastia longimana	0	1.33	2
Stempellinella spp	1.33	2.67	0
Tanytarsus spp	6.67	14.67	14
Cricotopus curtus	0	2.67	0
Heterotrissocladius changi	0	4	10
Pseudosmittia spp	0	1.33	2
Ablabesmyia monilis	1.33	0	0
Procladius spp	0	1.33	0
Amnicola limosa	84	282.67	360
Fossaria obrussa	13.33	2.67	0
Gyraulus deflectus	13.33	29.33	58
Helisoma anceps	1.33	2.67	4
Physella gyrina	32	16	30
Valvata tricarinata	50.67	44	172
Dreissena polymorpha	2.67	9.33	16
Sphaerium nitidum	0	0	4
Sphaerium striatinum	6.67	2.67	2
Pisidium casertanum	10.67	20	78
Pisidium ferrugineum	0	2.67	6
Pisidium henslowanum	5.33	2.67	12
Lumbriculus variegatus	0	0	4.16
Stylodrilus heringianus	5.73	45.73	12.48
Nais communis	0	19.6	0
Nais variabilis	3.82	0	4.16
Slavina appendiculata	20.99	32.67	74.88
Stylaria lacustris	59.16	130.67	62.4
im. tubifids w hair setae	0	19.6	0
im. tubificids w/o hair setae	1.91	26.13	12.48
Potamathrix vejdovskyi	1.91	0	4.16
Spirosperma ferox	3.82	52.27	29.12
Tubifex embryos	0	0	4.16
sample area code	1	1	1

Table 6: Benthic invertebrate data listing for 1991, transect 6 (Hamilton Beach), 5m depth. Data are for number of individuals in three replicate samples.

Prostoma graecense	0	2	0
Hyalella azteca	1	0	0
Chironomus anthracinus	3	6	1.33
Chironomus salinarius	0	2	0
Cryptochironomus spp	5	6	2.67
Polypedilum halterales	0	6	0
Tanytarsus spp	13	26	25.33
Cricotopus curtus	2	6	1.33
Psectrocladius simulans	0	4	0
Pisidium casertanum	12	48	25.33
Pisidium compressum	0	10	0
Pisidium lilljeborgi	6	12	4
Slavina appendiculata	0	7	0
im. tubificids w/o hair setae	133.44	336	25.33
Potamathrix vejdovskyi	2.78	7	2.67
Tubifex embryoe	2.78	0	0
sample area code	1	1	1

Table 7: Benthic invertebrate data listing for 1991, transect 7 (Bronte), 5m depth. Data are for number of individuals in three replicate samples.

Caenis spp	2	0	0
Mystacides spp	16	7	6.67
Lebertia spp	0	1	0
Piona spp	0	1	0
Hydrolimax grissue	0	1	0
Cura foremanii	0	3	1.33
Crangonyx spp	0	1	18.67
Gammarus fasciatus	68	10	4
Hyalella azteca	60	162	30.67
Caecidotea spp	58	5	36
Caecidotea intermedius	0	0	1.33
Erpobdellidae immatures	12	0	4
Helobdella stagnalis	6	0	6.67
Piscicola geometra	4	0	0
Chironomus salinarius	0	1	0
Cryptochironomus spp	0	1	1.33
Dicrotendipes fumidus	2	0	1.33
Harnischia spp	0	1	0
Parachironomus spp	0	1	0
Tanytarsus spp	14	3	2.67
Heterotrissocladius changi	18	5	22.67
Pseudosmittia spp	2	3	1.33
Synorthocladius spp	2	0	0
Thienemanniella spp	0	1	0
Ablabesmyia mallochi	0	0	1.33
Conchopelpopia spp	16	20	4
Amnicola limosa	94	46	55.9
Fossaria obrussa	2	1	0
Gyraulus deflectus	2	2	0
Gyraulus parvus	2	0	0
Helisoma anceps	2	1	1.3
Physella gyrina	14	6	0
Physella integra	0	0	6.5
Pleurocera acuta	28	14	13
Valvata sincera	0	8	0
Valvata tricarinata	10	0	2.6
Dreissena polymorpha	18	23	5.2
Sphaerium nitidum	0	0	2.6
Sphaerium striatinum	4	0	4.2
Pisidium casertanum	16	7	15.6
Pisidium compressum	0	0	6.5
Pisidium fallax	22	0	3.9
Lumbriculus variegatus	0	0	2.51
Stylodrilus heringianus	0	0	5.01
Chaetogaster diaphanus	0	4.32	0
Nais variabilis	0	4.32	0
Slavina appendiculata	0	0	2.51
Stylaria lacustris	134.67	216.04	32.59
im. tubifids w hair setae	11.88	0	5.01
im. tubificids w/o hair setae	39.61	0	67.68
Aulodrilus pigueti	0	4.32	0
Limnodrilus hoffmeisteri	0	0	2.51
Potamathrix vejdovskyi	11.88	0	5.01
Spirosperma ferox	3.96	0	2.51
sample area code	2	2	2

Table 8: Benthic invertebrate data listing for 1991, transect 8 (Oakville), 5m depth. Data are for number of individuals in three replicate samples.

Hydroptila spp	0	0	2
Mystacides spp	4	16	14
Oecetis spp	0	0	2
Hygrobates spp	0	4	2
Lebertia spp	24	48	14
Cura foremanii	0	8	0
Procotyla fluviatilis	0	4	0
Gammarus fasciatus	12	8	4
Hyalella azteca	4	8	2
Caecidotea spp	0	8	0
Helobdella stagnalis	0	0	2
Chironomini early instar	4	0	0
Chironomus salinarius	0	0	4
Cryptochironomus spp	0	0	10
Dicrotendipes spp	2	48	0
Dicrotendipes fumidus	164	284	94
Parachironomus spp	2	0	0
Parachironomus abortivus	0	4	0
Parachironomus frequens	4	0	0
Paratendipes spp	0	4	0
Potthastia longimana	2	4	2
Paratanytarsus spp	0	44	0
Tanytarsus spp	6	28	6
Cricotopus spp	4	0	2
Cricotopus curtus	4	0	10
Heterotrissocladius changi	0	0	2
Orthocladius spp	0	40	0
Psectrocladius spp	8	0	0
Psectrocladius simulans	16	84	24
Pseudosmittia spp	16	0	2
Synorthocladius spp	2	4	4
Thienemanniella spp	6	4	0
Conchopelpopia spp	146	232	76
Procladius spp	2	0	0
Gyraulus deflectus	10	0	12
Helisoma anceps	80	164	118
Physella gyrina	0	0	2
Pleurocera acuta	8	8	4
Valvata tricarinata	28	44	44
Dreissena polymorpha	8	8	0
Pisidium casertanum	4	0	2
Stylodrilus heringianus	24.58	16.78	17.1
Chaetogaster diaphanus	0	16.78	0
Nais variabilis	24.58	16.78	8.55
Slavina appendiculata	0	33.57	0
Stylaria lacustris	626.84	772.08	188.08
im. tubificids w/o hair setae	0	0	4.27
sample area code	2	2	2

Table 9: Benthic invertebrate data listing for 1991, transect 9 (Etobicoke), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides spp	64	72	28
Aturus spp	4	8	0
Hygrobates spp	56	12	0
Lebertia spp	16	0	0
Unionicola spp	4	0	0
Cura foremanii	0	16	0
Crangonyx spp	0	8	4
Hyalella azteca	392	372	364
Caecidotea spp	0	16	14
Dicrotendipes spp	20	0	0
Dicrotendipes fumidus	84	120	58
Parachironomus frequens	4	0	0
Phaenopsectra obediens	8	4	0
Potthastia longimana	4	0	0
Micropsectra spp	0	0	2
Paratanytarsus spp	0	0	6
Tanytarsus spp	8	4	2
Cricotopus spp	0	0	2
Cricotopus curtus	16	12	4
Heterotrissocladius spp	0	0	4
Heterotrissocladius changi	24	12	4
Orthocladius spp	0	0	10
Psectrocladius spp	0	0	10
Psectrocladius simulans	0	12	0
Tanypodinae	0	4	0
Conchopelpopia spp	28	16	8
Procladius spp	0	0	6
Thienemannimyia spp	0	0	2
Amnicola limosa	4	0	0
Gyraulus deflectus	0	8	12
Helisoma anceps	140	100	108
Physella gyrina	20	4	6
Valvata sincera	8	0	2
Valvata tricarinata	0	4	0
Dreissena polymorpha	4	0	0
Sphaerium nitidum	0	0	2
Pisidium casertanum	24	8	20
Pisidium henslowanum	0	0	2
Pisidium lilljeborgi	8	0	4
Pisidium ventricosum	0	4	0
Stylodrilus heringianus	16.96	12	8
Nais variabilis	4.24	0	0
Slavina appendiculata	12.72	0	0
Stylaria lacustris	152.64	96	14
im. tubifids w hair setae	8.48	8	0
im. tubificids w/o hair setae	8.48	8	4
Spirosperma ferox	8.48	0	0
sample area code	2	2	2

Table 10: Benthic invertebrate data listing for 1991, transect 10 (Humber Bay), 5m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	0	4	0
Lebertia spp	4	0	4
Piona spp	4	0	2
Hydrolimax grissue	0	2	0
Cura foremanii	0	2	0
Gammarus fasciatus	24	14	102
Hyalella azteca	28	0	0
Caecidotea spp	24	0	28
Caecidotea racovitzae	0	0	2
Helobdella elongata	0	0	4
Chironomus anthracinus	20	12	10
Chironomus salinarius	0	2	6
Cryptochironomus spp	0	2	0
Dicrotendipes fumidus	8	12	0
Harnischia spp	0	2	0
Potthastia longimana	0	2	0
Tanytarsus spp	0	6	2
Cricotopus spp	4	2	0
Cricotopus curtus	4	0	8
Heterotrissocladius changi	12	6	4
Psectrocladius simulans	4	4	4
Helisoma anceps	4	0	2
Valvata sincera	320	60	220
Pisidium casertanum	8	6	4
Stylodrilus heringianus	0	15.24	0
Nais communis	0	10.16	6
Nais simplex	4	0	0
Nais variabilis	4	5.08	2
Slavina appendiculata	8	0	2
Stylaria lacustris	0	0	2
Vejdovskyella intermedia	8	10.16	10
im. tubifids w hair setae	8	50.8	10
im. tubificids w/o hair setae	116	142.24	32
Potamathrix moldaviensis	0	10.16	2
Potamathrix vejdovskyi	20	10.16	8
Spirosperma ferox	0	0	12
sample area code	2	2	2

Table 11: Benthic invertebrate data listing for 1991, transect 11 (Toronto Island), 5m depth. Data are for number of individuals in three replicate samples.

Piona spp	0	1	0
Hyalella azteca	2	0	2
Chironomus anthracinus	0	1	8
Cryptochironomus spp	0	2	12
Polypedilum scalaenum	0	1	2
Tanytarsus spp	0	1	2
Helisoma anceps	2	0	0
Valvata tricarinata	2	0	0
Pisidium lilljeborgi	0	2	2
Nais variabilis	0	2	2
Piguetiella michiganensis	0	0	2
Stylaria lacustris	0	1	0
im. tubifids w hair setae	2	0	0
im. tubificids w/o hair setae	20	9	14
Potamathrix moldaviensis	0	2	4
Spirosperma ferox	0	0	2
sample area code	1	1	1

Table 12: Benthic invertebrate data listing for 1991, transect 12 (Birch Cliff), 5m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	0	0	2
Lebertia spp	2	0	0
Limnesia spp	6	0	20
Gammarus fasciatus	0	0	4
Chironomus anthracinus	6	10	0
Cryptochironomus spp	20	6	4
Dicrotendipes spp	2	0	6
Dicrotendipes tritanus	0	2	0
Paratendipes spp	2	0	0
Polypedilum scalaenum	24	64	28
Tribelos jaoundum	0	8	0
Tanytarsue spp	18	6	8
Cricotopus spp	0	0	4
Cricotopus curtus	0	6	0
Heterotrissocladius changi	30	14	6
Psectrocladius spp	0	20	2
Psectrocladius simulans	8	0	0
Conchopelpopia spp	2	0	0
Nais communis	5.4	5.6	0
Nais simplex	0	0	25.68
Naie variabilis	48.6	5.6	12.84
Stylaria lacuetris	0	5.6	0
Vejdovskyella intermedia	0	0	4.28
im. tubifids w hair setae	32.4	33.6	34.24
im. tubificids w/o hair setae	172.8	196	128.4
Potamathrix moldaviensis	10.8	5.6	0
Potamathrix vejdovskyi	0	16.8	8.56
Spirosperma ferox	0	11.2	0
sample area code	2	2	2

Table 13: Benthic invertebrate data listing for 1991, transect 13 (Guildwood), 5m depth. Data are for number of individuals in three replicate samples.

Lebertia spp	0	1	0
Limnesia spp	0	2	0
Chironomus anthracinus	1	0	2
Chironomus salinarius	1	0	0
Cryptochironomus spp	0	3	3
Dicrotendipes spp	0	1	0
Phaenopsectra obediens	0	0	4
Polypedilum spp	0	0	3
Polypedilum illinoense	0	0	1
Polypedilum scalaenum	1	4	31
Potthastia longimana	0	0	1
Tanytarsus spp	0	1	1
Beterotrissocladius spp	0	1	5
Psectrocladius spp	0	1	4
Vejdovskyella intermedia	1	39	75.2
im. tubificids w/o hair setae	5	3	4.8
sample area code	1	1	1

Table 14: Benthic invertebrate data listing for 1991, transect 14 (Whitby), 5m depth. Data are for number of individuals in three replicate samples.

Hydroptila spp	4	4	0
Mystacides spp	0	8	0
Oecetis inconspicua	0	4	0
Arrenurus spp	0	8	0
Aturus spp	12	0	0
Hygrobates spp	8	0	0
Limnesia spp	0	8	1
Piona spp	0	0	1
Torrenticola spp	0	4	0
Hydrolimax grissue	0	4	1
Cura foremanii	0	4	0
Diaporeia spp	0	0	2
Gammarus fasciatus	28	40	0
Hyalella azteca	124	96	2
Caecidotea spp	56	8	0
Glossiphonia complanata	0	4	0
Helobdella stagnalis	4	24	0
Cryptochironomus spp	0	4	1
Dicrotendipes spp	0	4	0
Microtendipes spp	8	40	0
Paracladopelma nereis	4	0	0
Polypedilum spp	4	0	0
Polypedilum illinoense	4	0	0
Stictochironomus spp	0	76	0
Potthastia longimana	0	36	0
Micropsectra spp	40	8	5
Paratanytarsus spp	44	28	0
Tanytarsus spp	0	4	0
Cricotopus curtus	4	28	3
Heterotrissocladius changi	16	32	10
Pseudosmittia spp	12	16	0
Conchopelpopia spp	8	4	0
Amnicola limosa	8	0	0
Physella gyrina	0	4	0
Pleurocera acuta	4	0	0
Valvata tricarinata	40	48	0
Pisidium casertanum	0	16	1
Pisidium ferrugineum	16	8	0
Pisidium nitidum	4	0	0
Stylodrilus heringianus	0	4.28	9
Nais variabilis	52	51.31	0
Stylaria lacustris	12	25.66	0
Vejdovskyella intermedia	0	0	8
im. tubifids w hair setae	16	8.55	0
im. tubificids w/o hair setae	44	25.66	12
Potamathrix moldaviensis	16	8.55	0
Potamathrix vejdovskyi	4	0	0
Spirosperma ferox	16	0	0
Tasserkidrilus superiorensis	0	0	2
sample area code	2	2	2

Table 15: Benthic invertebrate data listing for 1991, transect 15 (Newcastle), 5m depth. Data are for number of individuals in three replicate samples.

Promoresia tardella	0	0	4
Hygrobates spp	1.33	0	20
Piona spp	2.67	0	8
Gammarus fasciatus	4	2.67	52
Hyalella azteca	4	0	36
Caecidotea spp	5.33	0	68
Chironomus anthracinus	1.33	0	0
Cryptochironomus spp	0	0	4
Dicrotendipes fumidus	2.67	0	8
Microtendipes spp	10.67	1.33	0
Phaenopsectra obediens	20	20	116
Potthastia longimana	1.33	0	0
Paratanytarsus spp	44	17.33	4
Tanytarsus spp	45.33	2.67	8
Cricotopus curtus	0	2.67	0
Heterotrissocladius changi	2.67	0	0
Psectrocladius spp	9.33	0	0
Pseudosmittia spp	1.33	0	0
Ablabesmyia monilis	0	0	4
Conchopelpopia spp	8	1.33	4
Amnicola limosa	0	1.33	0
Sphaerium nitidum	0	0	4
Pisidium casertanum	2.67	5.33	0
Pisidium lilljeborgi	1.33	0	0
Stylodrilus heringianus	0	1.39	0
Nais behningi	0	0	4
Nais communis	0	0	4
Nais variabilis	2.67	0	4
Slavina appendiculata	0	0	4
Stylaria lacustris	0	0	8
Vejdovskyella intermedia	20	26.43	16
im. tubifids w hair setae	0	4.17	0
im. tubificids w/o hair setae	14.67	22.26	12
Aulodrilus pigueti	0	1.39	0
Spirosperma ferox	0	8.3	0
Tasserkidrilus superiorensis	2.67	0	0
sample area code	1	1	1

Table 16: Benthic invertebrate data listing for 1991, transect 16 (Port Hope), 5m depth. Data are for number of individuals in three replicate samples.

Caenis spp	40	40	12
Hygrobates spp	0	0	32
Piona spp	24	12	4
Torrenticola spp	4	4	0
Cura foremanii	8	8	12
Gammarus fasciatus	52	44	56
Hyalella azteca	148	76	60
Caecidotea spp	4	0	0
Helobdella stagnalis	8	0	4
Cryptochironomus spp	4	0	0
Dicrotendipes spp	4	0	0
Dicrotendipes fumidus	32	0	4
Microtendipes spp	92	48	36
Paracladopelma undine	4	0	0
Paratendipes spp	8	0	0
Polypedilum laetum	0	8	0
Stictochironomus spp	0	0	4
Potthastia longimana	12	0	0
Paratanytarsus spp	176	240	44
Stempellina bausei	0	32	12
Tanytarsus spp	376	136	112
Cricotopus curtus	124	116	64
Heterotrissocladius changi	32	12	12
Psectrocladius simulans	4	0	0
Thienemanniella spp	4	0	0
Conchopelpopia spp	48	24	24
Gyraulus deflectus	0	4	4
Physella gyrina	4	16	12
Pisidium casertanum	4	0	0
Chaetogaster diaphanus	4	8	4.4
Nais barbata	8	0	0
Stylaria lacustris	80	64	105.6
Uncinais uncinata	0	0	4.4
Vejdovskyella intermedia	28	40	17.6
im. tubificids w/o hair setae	4	0	0
sample area code	1	1	1

Table 17: Benthic invertebrate data listing for 1991, transect 17 (Cobourg), 5m depth. Data are for number of individuals in three replicate samples.

Caenis spp	8	12	0
Mystacides sepulchralis	0	0	32
Stenacron interpunctatum	0	0	8
Hygrobates spp	0	4	56
Piona spp	0	20	0
Torrenticola spp	4	0	16
Hydrozetes spp	0	4	0
Porohmannella spp	0	8	0
Prostoma graecense	0	4	0
Cura foremanii	20	0	0
Dugesia tigrina	32	4	104
Crangonyx spp	0	0	8
Gammarus fasciatus	76	20	64
Hyalella azteca	728	268	768
Orconectes propinquus	4	0	0
Caecidotea spp	4	8	64
Caecidotea intermedius	4	0	0
Caecidotea racovitzae	16	0	0
Glossiphonia complanata	8	0	0
Cryptochironomus spp	0	0	8
Dicrotendipes fumidus	24	8	24
Microtendipes spp	76	32	88
Phaenopsectra obediens	0	0	24
Stictochironomus spp	0	0	40
Monodiamesa spp	0	0	8
Potthastia longimana	0	0	8
Paratanytarsus spp	84	72	136
Stempellina bausei	8	0	8
Tanytarsus spp	108	84	168
Cricotopus curtus	8	40	88
Heterotrissocladius changi	68	20	72
Parakiefferiella spp	0	0	8
Psectrocladius simulans	52	4	8
Pseudosmittia spp	4	0	0
Ablabesmyia monilis	0	0	16
Conchopelpopia spp	20	12	24
Amnicola limosa	140	32	80
Gyraulus deflectus	12	24	32
Physella gyrina	40	24	72
Pleurocera acuta	68	32	16
Probythinella lacustris	88	44	80
Valvata tricarinata	24	56	24
Pisidium casertanum	8	4	8
Pisidium compressum	4	0	0
Pisidium lilljeborgi	0	4	0
Pisidium nitidum	12	0	0
Pisidium variabile	8	0	0
Stylodrilus heringianus	12.51	0	40
Chaetogaster diaphanus	4.17	0	0
Nais behningi	8.34	0	0
Nais variabilis	12.51	0	0
Piguetiella michiganensis	4.17	4	0
Slavina appendiculata	12.51	0	8
Stylaria lacustris	91.74	48	72
Vejdovskyella intermedia	41.7	4	56
im. tubifids w hair setae	0	4	32
im. tubificids w/o hair setae	8.34	0	24
Limnodrilus hoffmeisteri	0	0	40
Spirosperma ferox	0	0	8
sample area code	1	1	1

Table 18: Benthic invertebrate data listing for 1991, transect 18 (Presqu'ile), 5m depth. Data are for number of individuals in three replicate samples.

Hydroptila spp	0	0	4
Mystacides spp	4	0	0
Mystacides sepulchralis	0	0	8
Ceraclea tarsipunctata	0	0	4
Nectopsyche exquisita	0	4	0
Oecetis spp	0	0	8
Oecetis inconspicua	12	0	8
Hygrobates spp	0	0	32
Mideopsis spp	0	0	16
Piona spp	0	0	20
Hydrolimax grissue	0	0	4
Dugesia tigrina	0	0	4
Gammarus fasciatus	776	800	1804
Caecidotea spp	8	8	8
Chironomini early instar	4	0	0
Cryptochironomus spp	12	20	24
Dicrotendipes spp	4	0	0
Dicrotendipes fumidus	12	4	12
Dicrotendipes modestus	0	0	4
Microtendipes spp	60	52	60
Paralauterborniella spp	0	0	4
Phaenopsectra spp	12	0	0
Pseudochironomus spp	0	12	24
Monodiamesa tuberculata	0	0	4
Cladotanytarsus spp	0	16	0
Micropsectra spp	0	0	8
Paratanytarsus spp	0	0	8
Tanytarsus spp	0	72	188
Tanytarsus chinyensis	104	0	0
Zavrelia spp	0	4	32
Orthocladiinae	12	16	0
Cricotopus spp	16	32	0
Heterotrissocladius changi	48	28	48
Nanocladius spiniplenus	0	4	0
Parakiefferiella spp	0	0	32
Psectrocladius simulans	12	0	32
Pseudosmittia spp	120	48	124
Ablabesmyia monilis	52	4	0
Conchopelpopia spp	32	4	76
Procladius spp	0	12	0
Amnicola limosa	8	4	8
Physella gyrina	0	4	0
Pleurocera acuta	0	4	4
Probythinella lacustris	204	168	436
Valvata piscinalis	0	16	0
Valvata sincera	0	4	4
Valvata tricarinata	8	0	28
Dreissena polymorpha	4	0	0
Pisidium casertanum	20	116	156
Pisidium henslowanum	36	0	20
Pisidium lilljeborgi	20	8	20
Pisidium nitidum	0	20	0
Pisidium subtruncatum	0	0	8
Pisidium ventricosum	0	4	0
Stylodrilus beringianus	41.9	52	131.05
Nais behningi	0	0	8.19
Nais communis	8.4	8	20.5
Nais variabilis	8.38	0	8.2
Stylaria lacustris	4.19	0	4.1
Uncinais uncinata	4.19	0	0
im. tubifids w hair setae	4.19	4	0
im. tubificids w/o hair setae	8.38	4	0
Spirosperma ferox	8.38	0	0
sample area code	2	2	2

Table 19: Benthic invertebrate data listing for 1991, transect 19 (Robinson Point), 5m depth. Data are for number of individuals in three replicate samples.

Heptageniidae	0	4	2
Hydroptila spp	0	0	10
Ceraclea spp	0	0	2
Oecetis spp	0	8	0
Limnesia spp	16	16	0
Mideopsis spp	0	4	0
Piona spp	8	8	0
Torrenticola spp	24	4	0
Unionicola spp	16	0	0
Hydrozetes spp	0	8	2
Porohmannella spp	0	4	0
Hydridae spp	0	8	0
Hydrolimax grissue	8	24	0
Cura foremanii	136	32	0
Dugesia tigrina	136	28	0
Gammarus fasciatus	176	132	124
Hyalella azteca	536	220	0
Caecidotea spp	24	12	0
Caecidotea racovitzae	0	4	0
Cryptochironomus spp	0	4	0
Dicrotendipes fumidus	8	0	0
Dicrotendipes neomodestus	0	24	0
Microtendipes spp	72	16	0
Pseudochironomus spp	0	20	0
Cladotanytarsus spp	0	4	0
Micropsectra spp	0	16	2
Tanytarsus spp	32	40	2
Heterotrissocladius changi	40	16	4
Parakiefferiella spp	8	4	0
Pseudosmittia spp	8	8	42
Ablabesmyia spp	8	0	0
Ablabesmyia monilis	8	0	0
Conchopelpopia spp	8	48	6
Procladius spp	56	8	0
Amnicola limosa	16	16	14
Fossaria obrussa	32	12	0
Gyraulus deflectus	0	8	0
Physella gyrina	336	392	20
Pleurocera acuta	0	4	10
Probythinella lacustris	976	912	108
Stagnicola catascopium	0	0	10
Valvata tricarinata	16	24	12
Sphaerium nitidum	8	12	6
Pisidium casertanum	24	32	0
Pisidium henslowanum	0	8	2
Stylodrilus heringianus	0	12	0
Chaetogaster diaphanus	24	8	0
Nais pseudobtusa	16	4	0
Nais variabilis	16	0	0
Slavina appendiculata	104	0	0
Stylaria lacustris	40	16	0
Vejdovskyella intermedia	40	20	0
im. tubifids w hair setae	0	4	0
sample area code	2	2	2

Table 20: Benthic invertebrate data listing for 1991, transect 20 (Spencer Point), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralis	4	0	0
Oecetis spp	4	4	0
Arrenurus spp	4	0	0
Hygrobates spp	8	8	3.98
Sperchonopsis spp	0	4	0
Torrenticola spp	0	8	0
Hydrozetes spp	4	4	0
Porohmannella spp	4	0	3.98
Hydridae spp	16	0	0
Cura foremanii	20	4	0
Dugesia tigrina	72	28	63.75
Gammarus fasciatus	176	136	203.19
Hyalella azteca	480	344	318.73
Dicrotendipes fumidus	12	0	3.98
Dicrotendipes modestus	4	12	0
Microtendipes spp	0	12	0
Parachironomus abortivus	4	0	0
Pseudochironomus spp	12	8	0
Cladotanytarsus spp	12	0	0
Micropsectra spp	16	32	3.98
Tanytarsus spp	44	0	7.97
Zavrelia spp	8	0	0
Heterotrissocladius changi	32	4	7.97
Psectrocladius simulans	4	0	3.98
Pseudosmittia spp	0	4	7.97
Conchopelpopia spp	72	108	43.82
Amnicola limosa	8	12	11.95
Fossaria obrussa	20	20	27.89
Gyraulus deflectus	4	8	0
Helisoma anceps	0	12	7.97
Physella gyrina	268	356	227.09
Pierosoma trivolvis	0	4	0
Probythinella lacustris	528	664	633.47
Stagnicola catascopium	0	4	0
Valvata sincera	0	4	0
Valvata tricarinata	4	16	7.97
Sphaerium nitidum	4	0	0
Pisidium casertanum	4	0	0
Chaetogaster diaphanus	12.43	16	0
Nais pseudobtusa	4.14	0	3.98
Nais variabilis	0	28	0
Pristina leidyi	8.29	4	3.98
Pristinella osborni	0	4	0
Slavina appendiculata	4.14	0	0
Stylaria lacustris	82.86	28	19.92
Uncinais uncinata	4.14	0	0
Arcteonais lomondi	0	4	0
sample area code	2	2	2

Table 21: Benthic invertebrate data listing for 1991, transect 21 (Outlet Beach), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralis	0	0	1
Leptoceridae	1	0	0
Hygrobates spp	1	0	1
Lebertia spp	0	0	1
Limnesia spp	6	14	4
Piona spp	1	2	4
Prostoma graecense	6	2	2
Cryptochironomus spp	0	2	2
Dicrotendipes fumidus	1	0	0
Dicrotendipes modestus	1	0	0
Paracladopelma spp	0	0	1
Paraclodpelma winnelli	1	0	0
Paratendipes albimanus	0	2	0
Pseudochironomus spp	3	0	0
Stictochironomus spp	4	23	15
Potthastia spp	0	0	3
Potthastia longimana	1	0	0
Cladotanytarsus spp	3	2	1
Stempellina bausei	1	0	0
Tanytarsus spp	20	11	8
Orthocladiinae	0	0	1
Cricotopus spp	3	0	0
Heterotrissocladius changi	1	0	0
Psectrocladius spp	0	14	0
Psectrocladius simulans	3	0	3
Conchopelpopia spp	0	0	5
Amnicola limosa	1	0	1
Cincinnatis cincinnatiensis	0	0	2
Helisoma anceps	0	1	0
Physella gyrina	0	1	3
Valvata sincera	22	14	2
Valvata tricarinata	22	12	7
Sphaerium striatinum	5	0	5
Pisidium amnicum	2	5	1
Pisidium casertanum	99	48	54
Pisidium compressum	0	0	1
Pisidium fallax	0	0	1
Pisidium henslowanum	2	0	0
Pisidium lilljeborgi	6	3	0
Pisidium nitidum	4	0	1
Stylodrilus heringianus	0	2.17	0
Vejdovskyella intermedia	0	2.17	0
im. tubifids w hair setae	0	1.09	1
im. tubificids w/o hair setae	14	31.49	34
Potamathrix moldaviensis	0	1.09	0
sample area code	1	1	1

Table 22: Benthic invertebrate data listing for 1991, transect 22 (Ostrander Point), 5m depth. Data are for number of individuals in three replicate samples.

Caenis spp	4	0	0
Hydroptila spp	0	2	0
Mystacides spp	0	2	4
Stenonema femoratum	4	0	0
Oecetis spp	0	2	0
Arrenurus spp	0	2	0
Lebertia spp	0	2	0
Limnesia spp	24	0	0
Sperchonopsis spp	0	2	0
Unionicola spp	0	6	0
Gammarus fasciatus	180	200	138
Hyalella azteca	124	0	0
Orconectes propinquus	4	0	0
Caecidotea spp	52	2	0
Caecidotea racovitzae	4	0	0
Cryptochironomus spp	8	0	0
Dicrotendipes fumidus	0	4	2
Dicrotendipes neomodestus	20	0	0
Microtendipes spp	32	0	0
Nilothauma babiyi	8	0	0
Pseudochironomus spp	4	0	0
Tanytarsus spp	52	20	2
Zavrelia spp	40	2	0
Heterotrissocladius changi	4	0	0
Psectrocladius simulans	0	2	2
Pseudosmittia spp	4	18	16
Tanypodinae	4	0	0
Ablabesmyia spp	16	0	0
Ablabesmyia monilis	20	10	0
Conchopelpopia spp	16	12	12
Amnicola limosa	12	22	8
Bythinia tentaculata	0	6	0
Fossaria obrussa	4	0	0
Helisoma anceps	0	4	0
Physella gyrina	152	26	10
Pleurocera acuta	0	8	16
Probythinella lacustris	296	170	120
Stagnicola catascopium	0	32	14
Valvata sincera	8	0	0
Valvata tricarinata	16	8	4
Sphaerium nitidum	4	0	0
Pisidium casertanum	8	14	2
Pisidium lilljeborgi	0	2	0
Stylodrilus heringianus	8	0	0
Stylaria lacustris	8	0	0
sample area code	2	2	2

Table 23: Benthic invertebrate data listing for 1991, transect 23 (Prince Edward Point), 5m depth. Data are for number of individuals in three replicate samples.

Mystacides spp	592	384	76
Ceraclea spp	8	0	0
Oecetis spp	8	24	16
Hygrobates spp	32	24	0
Lebertia spp	16	0	8
Limnesia spp	144	40	32
Piona spp	16	80	4
Unionicola spp	8	0	0
Hydrozetes spp	0	16	0
Porohmannella spp	64	16	0
Hydridae spp	0	24	0
Prostoma graecense	8	0	0
Hydrolimax grissue	80	112	0
Dugesia tigrina	112	112	0
Procotyla fluviatilis	32	16	0
Gammarus fasciatus	8	56	12
Hyalella azteca	0	0	8
Caecidotea spp	8	0	12
Helobdella stagnalis	0	0	4
Dicrotendipes modestus	8	0	0
Dicrotendipes neomodestus	8	0	0
Microtendipes spp	24	0	0
Parachironomus frequens	8	0	0
Paratendipes albimanus	32	0	0
Pseudochironomus spp	8	0	0
Tanytarsus spp	32	0	0
Pseudosmittia spp	8	0	0
Ablabesmyia monilis	32	0	0
Conchopelpopia spp	8	0	0
Amnicola limosa	64	104	60
Bythinia tentaculata	0	24	20
Fossaria obrussa	16	64	20
Physella gyrina	64	112	20
Pleurocera acuta	8	24	32
Probythinella lacustris	1512	1392	204
Valvata sincera	0	8	20
Valvata tricarinata	408	584	120
Musculium partumeium	0	8	4
Sphaerium nitidum	24	24	28
Pisidium casertanum	120	112	196
Pisidium fallax	104	40	20
Pisidium ferrugineum	80	24	16
Pisidium henslowanum	16	8	4
Pisidium lilljeborgi	160	40	32
Pisidium nitidum	8	16	24
Manayunkia speciosa	72	52.24	17.78
Enchytraeidae	8	0	0
Stylodrilus heringianus	0	8.71	0
Nais communis	8	8.7	0
Nais pseudobtusa	0	8.71	0
Nais simplex	0	8.71	0
Nais variabilis	8	0	4.4
Slavina appendiculata	32	60.94	4.44
Stylaria lacustris	16	52.24	8.89
Vejdovskyella intermedia	24	17.41	0
im. tubifids w hair setae	88	0	0
im. tubificids w/o hair setae	0	60.94	4.44
Potamathrix moldaviensis	0	17.41	0
Spirosperma ferox	8	0	0
sample area code	3	3	3

Table 24: Benthic invertebrate data listing for 1991, transect 24 (Prince Edward Bay), 5m depth. Data are for number of individuals in three replicate samples.

Caenis spp	5.33	0	0
Oecetis spp	42.67	0	0
Arrenurus spp	0	8	2
Hygrobates spp	26.67	40	14
Lebertia spp	0	8	0
Piona spp	16	16	4
Sperchonopsis spp	0	0	4
Torrenticola spp	0	0	4
Unionicola spp	5.33	0	4
Porohmannella spp	0	16	2
Hydridae spp	0	0	4
Hydrolimax grissue	26.67	88	26
Dugesia tigrina	48	88	36
Procotyla fluviatilis	10.67	8	6
Crangonyx spp	0	0	38
Diaporeia spp	10.67	0	0
Gammarus fasciatus	58.67	16	16
Hyalella azteca	42.67	56	18
Orconectes propinquus	0	0	6
Caecidotea spp	21.33	24	40
Glossiphonia complanata	10.67	0	0
Helobdella stagnalis	5.33	0	0
Cladopelma spp	53.33	64	0
Cryptotendipes spp	5.33	0	0
Dicrotendipes spp	10.67	0	0
Dicrotendipes modestus	21.33	0	0
Paratendipes spp	0	16	0
Paratendipes albimanus	16	16	0
Phaenopsectra spp	0	8	0
Phaenopsectra obediens	5.33	0	0
Polypedilum illinoense	5.33	0	0
Polypedilum scalaenum	0	8	0
Pseudochironomus spp	0	8	0
Stictochironomus spp	5.33	0	0
Cladotanytarsus spp	32	56	0
Tanytarsus spp	37.33	88	0
Ablabesmyia mallochi	10.67	56	0
Amnicola limosa	6	120	24
Bythinia tentaculata	0	16	4
Helisoma anceps	1	0	0
Physella gyrina	4	8	0
Pierosoma trivolvis	0	0	2
Promenetus exacuus	1	0	0
Stagnicola catascopium	0	0	10
Valvata sincera	1	0	0
Valvata tricarinata	1	8	0
Dreissena polymorpha	1	0	0
Sphaerium nitidum	1	24	14
Sphaerium striatinum	0	0	2
Pisidium casertanum	1	40	6
Pisidium fallax	0	16	0
Pisidium ferrugineum	1	8	0
Pisidium lilljeborgi	2	32	2
Pisidium nitidum	6	0	0
Enchytraeidae	10.67	16	4
Stylodrilus heringianus	0	8	0
Nais variabilis	10.67	0	0
Pristina leidyi	0	0	2
Slavina appendiculata	10.67	0	0
im. tubifids w hair setae	0	8	6
im. tubificids w/o hair setae	5.33	24	4
Isochaetes freyi	5.33	0	0
Potamathrix vejdovskyi	0	0	2
Spirosperma ferox	37.33	56	18
Tubifex embryos	0	16	0
sample area code	1	1	1

Table 25: Benthic invertebrate data listing for 1991, transect 25 (Amherst Island), 5m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	12	28	0
Lebertia spp	0	0	2
Limnesia spp	0	0	4
Piona spp	0	8	0
Unionicola spp	4	12	0
Hydrolimax grissue	104	268	38
Dugesia tigrina	12	20	4
Crangonyx spp	4	0	0
Diaporeia spp	4	0	0
Gammarus fasciatus	268	244	174
Hyalella azteca	4	0	0
Caecidotea spp	40	68	14
Caecidotea racovitzae	8	4	2
Helobdella stagnalis	0	4	0
Amnicola limosa	12	0	0
Fossaria obrussa	8	0	0
Helisoma anceps	0	0	2
Physella gyrina	12	0	2
Valvata sincera	0	0	2
Valvata tricarinata	0	4	0
Lasmigona complanata	4	0	0
Sphaerium nitidum	0	4	0
Pisidium casertanum	100	32	0
Pisidium lilljeborgi	4	4	0
Slavina appendiculata	0	4	0
Vejdovskyella intermedia	12	0	6
im. tubifids w hair setae	24	24	6
im. tubificids w/o hair setae	92	140	20
Limnodrilus hoffmeisteri	12	24	0
Potamathrix vejdovskyi	0	8	0
Spirosperma ferox	4	0	0
sample area code	1	1	1

DATA APPENDIX
LAKE ONTARIO BENTHIC INVERTEBRATES
1981 AND 1991 COMPARISON

Results for:

1991, 20m depth

- numbers per sample
- sample areas were:
  - 78 cm^2 (sample area code 1)
  - 929 cm^2 (sample area code 2)
  - 625 cm^2 (sample area code 3)

- lower size limit was 200 um

Table 1: Benthic invertebrate data listing for 1991, transect 1 (Niagara-on-the-Lake), 20m depth. Data are for number of individuals in three replicate samples.

Bythinia tentaculata	1	0	0
Gyraulus parvus	0	0	2
Probythinella lacustris	5	0	4
Valvata sincera	0	0	2
Valvata tricarinata	1	0	0
Dreissena polymorpha	0	1	0
Sphaerium nitidum	2	1	1
Sphaerium striatinum	0	1	0
Pisidium ferrugineum	4	3	10
Pisidium henslowanum	1	0	1
Pisidium lilljeborgi	18	3	9
Pisidium subtruncatum	0	0	1
Stylodrilus heringianus	0	0	9
Aulodrilus pluriseta	0	0	1
Spirosperma ferox	0	0	3
sample area code	1	1	1

Table 2: Benthic invertebrate data listing for 1991, transect 2 (Port Dalhousie), 20m depth. Data are for number of individuals in three replicate samples.

Gammarus fasciatus	28	16	7
Cricotopus curtus	4	0	0
Gyraulus parvus	0	4	0
Physella gyrina	8	0	1
Pleurocera acuta	8	0	1
Probythinella lacustris	8	0	2
Valvata sincera	0	24	4
Valvata tricarinata	0	4	0
Dreissena polymorpha	0	4	0
Sphaerium nitidum	0	12	0
Pisidium casertanum	4	0	0
Pisidium ferrugineum	12	56	25
Pisidium henslowanum	0	0	1
Pisidium lilljeborgi	32	56	9
Stylodrilus heringianus	153.12	296.96	63.84
Stylaria lacustris	9.28	0	0
im. tubificids w/o hair setae	13.92	55.68	6.72
Aulodrilus pluriseta	0	0	1.68
Limnodrilus hoffmeisteri	0	9.28	0
Potamathrix vejdoovskyi	0	18.56	0
Spirosperma ferox	55.68	83.52	11.76
sample area code	1	1	1

Table 3: Benthic invertebrate data listing for 1991, transect 3 (Jordan Harbour), 20m depth. Data are for number of individuals in three replicate samples.

Piona spp	0	0	1
Gammarus fasciatus	0	1	0
Chironomus salinarius	0	1	0
Fossaria obrussa	0	1	0
Probythinella lacustris	0	1	0
Valvata sincera	0	3	2
Valvata tricarinata	4	0	1
Sphaerium nitidum	8	6	1
Pisidium casertanum	4	4	2
Pisidium ferrugineum	32	21	60
Pisidium henslowanum	0	1	0
Pisidium lilljeborgi	32	5	12
Stylodrilus heringianus	24	5	2
Stylaria lacustris	0	1	0
im. tubificids w/o hair setae	40	1	1
Limnodrilus hoffmeisteri	20	0	0
Potamathrix vejdoovskyi	0	1	0
Spirosperma ferox	16	2	0
Tubifex embryos	0	0	1
sample area code	1	1	1

Table 4: Benthic invertebrate data listing for 1991, transect 4 (Beamsville), 20m depth. Data are for number of individuals in three replicate samples.

Valvata sincera	4	0	4
Valvata tricarinata	0	4	0
Sphaerium nitidum	0	0	2
Pisidium casertanum	92	112	52
Pisidium ferrugineum	24	12	20
Pisidium henslowanum	4	0	0
Pisidium lilljeborgi	8	12	10
Stylodrilus heringianus	116	90.72	127.6
Slavina appendiculata	4	0	0
Vejdovskyella intermedia	0	5.04	0
im. tubifids w hair setae	0	0	8.8
im. tubificids w/o hair setae	12	5.04	22
Aulodrilus pluriseta	4	0	0
Potamathrix moldaviensis	4	0	0
Potamathrix vejdoovskyi	4	80.64	61.6
Spirosperma ferox	28	70.56	0
sample area code	1	1	1

Table 5: Benthic invertebrate data listing for 1991, transect 5 (Stoney Creek), 20m depth. Data are for number of individuals in three replicate samples.

Caenis spp	1	0	0
Gammarus fasciatus	2	0	0
Hyalella azteca	0	1	0
Cricotopus bicinotus	1	0	0
Amnicola limosa	1	0	0
Valvata tricarinata	2	0	0
Pisidium casertanum	7	6	0
Pisidium lilljeborgi	3	5	0
Stylodrilus heringianus	1	23	2.25
Slavina appendiculata	2	0	0
Stylaria lacustris	1	1	0
Vejdovskyella intermedia	0	0	2.25
im. tubificids w/o hair setae	8	0	4.5
Potamathrix moldavieneis	1	0	0
Potamathrix vejdoovskyi	7	1	9
Spirosperma ferox	1	0	0
sample area code	1	1	1

Table 6: Benthic invertebrate data listing for 1991, transect 6 (Hamilton Beach), 20m depth. Data are for number of individuals in three replicate samples.

Paratendipes albimanus	1	0	0
Heterotrissocladius changi	0	0	1
Sphaerium nitidum	1	0	1
Pisidium casertanum	23	11	23
Pisidium ferrugineum	8	3	5
Pisidium lilljeborgi	2	3	11
Stylodrilus heringianus	11	9.3	18
Stylaria lacustris	1	0	0
Vejdovskyella intermedia	3	0	3
im. tubifids w hair setae	1	7.44	3
im. tubificids w/o hair setae	16	46.5	7
Limnodrilus hoffmeisteri	0	1.86	0
Potamathrix moldaviensis	2	5.58	1
Potamathrix vejdoovskyi	12	22.32	0
Tubifex embryos	2	0	0
sample area code	1	1	1

Table 7: Benthic invertebrate data listing for 1991, transect 7 (Bronte), 20m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	1.33	0	3
Piona spp	0	1	5
Unionicola spp	0	1	1
Prostoma graecense	0	0	1
Hydrolimax grissue	0	0	8
Procotyla fluviatilis	1.33	0	0
Gammarus fasciatus	0	1	0
Caecidotea spp	0	2	0
Piscicola geometra	0	6	0
Dicrotendipes fumidus	0	0	2
Paraclodpelma winnelli	0	1	0
Micropsectra spp	0	0	3
Tanytarsus spp	0	2	0
Heterotrissocladius changi	0	38	2
Procladius spp	4	0	2
Physella gyrina	6.67	10	11
Valvata sincera	56	30	26
Dreissena polymorpha	5.33	2	2
Sphaerium nitidum	20	3	5
Pisidium casertanum	253.33	49	221
Pisidium ferrugineum	9.33	0	0
Pisidium henslowanum	21.33	2	6
Pisidium lilljeborgi	28	2	7
Lumbriculus variegatus	8.27	0	0
Stylodrilus heringianus	74.4	27.12	16.56
Slavina appendiculata	24.8	9.04	0
Stylaria lacustris	0	117.52	8.28
Vejdovskyella intermedia	0	0	8.28
im. tubifids w hair setae	49.6	36.16	91.08
im. tubificids w/o hair setae	124	253.12	124.2
Aulodrilus pluriseta	8.27	0	0
Limnodrilus hoffmeisteri	0	9.04	0
Potamathrix bedoti	0	0	8.28
Potamathrix vejdoovskyi	90.93	0	132.48
Spirosperma ferox	33.07	0	24.84
sample area code	2	2	2

Table 8: Benthic invertebrate data listing for 1991, transect 8 (Oakville), 20m depth. Data are for number of individuals in three replicate samples.

Lebertia spp	0	0	6
Hydrolimax grissue	0	0	4
Gammarus fasciatus	4	0	0
Caecidotea spp	0	4	2
Chironomus anthracinus	0	8	0
Parachironomus frequens	0	4	0
Micropsectra spp	0	0	2
Heterotrissocladius changi	1.33	0	0
Psectrocladius simulans	0	0	2
Procladius spp	0	0	4
Helisoma anceps	8	4	0
Physella gyrina	4	4	2
Valvata sincera	2.67	4	0
Valvata tricarinata	1.33	0	0
Sphaerium nitidum	1.33	0	4
Pisidium casertanum	69.33	128	38
Pisidium lilljeborgi	8	0	6
Pisidium ventricosum	2.67	4	4
Slavina appendiculata	0	0	6.24
Vejdovskyella intermedia	0	0	24.96
im. tubifids w hair setae	38.13	144.56	87.36
im. tubificids w/o hair setae	125.84	333.6	137.28
Limnodrilus hoffmeisteri	0	0	6.24
Limnodrilus udekemianus	3.81	0	0
Potamathrix vejdoovskyi	15.25	55.6	24.96
Spirosperma ferox	7.63	22.24	18.72
Tubifex embryos	0	0	6.24
sample area code	2	2	2

Table 9: Benthic invertebrate data listing for 1991, transect 9 (Etobicoke), 20m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	0	1.33	0
Lebertia spp	0	1.33	0
Hyalella azteca	0	6.67	0
Caecidotea spp	2	0	0
Micropsectra spp	0	2.67	0
Tanytarsus spp	0	4	0
Heterotrissocladius changi	16	6.67	6
Procladius spp	8	5.33	0
Gyraulus deflectus	2	0	0
Physella gyrina	2	0	0
Valvata sincera	4	4	6
Pisidium casertanum	60	40	40
Pisidium lilljeborgi	4	0	0
Pisidium nitidum	4	0	0
Stylodrilus heringianus	0	18.35	5.96
Slavina appendiculata	0	4.59	17.88
im. tubifids w hair setae	231.2	82.56	77.48
im. tubificids w/o hair setae	176.8	82.56	166.88
Aulodrilus pluriseta	13.6	0	5.96
Limnodrilus hoffmeisteri	40.8	0	0
Potamathrix bedoti	27.2	0	0
Potamathrix moldaviensis	13.6	0	0
Potamathrix vejdoovskyi	176.8	22.93	0
Spirosperma ferox	0	18.35	23.84
sample area code	2	2	2

Table 10: Benthic invertebrate data listing for 1991, transect 10 (Humber Bay), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	9	4	24
Gammarus fasciatus	1	0	0
Caecidotea spp	0	1	2
Micropsectra spp	0	0	10
Heterotrissocladius changi	3	1	0
Procladius spp	1	3	2
Sphaerium nitidum	0	1	0
Pisidium casertanum	2	0	0
Pisidium ferrugineum	1	2	0
Pisidium lilljeborgi	10	18	40
Stylodrilus heringianus	26	16	38
im. tubifids w hair setae	13	9	4
im. tubificids w/o hair setae	10	19	8
Potamathrix moldaviensis	0	2	4
Spirosperma ferox	0	0	2
sample area code	1	1	1

Table 11: Benthic invertebrate data listing for 1991, transect 11 (Toronto Island), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	5	1	3
Gammarus fasciatus	0	2	0
Caecidotea spp	1	1	2
Chironomus anthracinus	1	0	1
Heterotrissocladius changi	0	0	1
Pisidium casertanum	0	0	4
Pisidium lilljeborgi	1	1	1
Pisidium subtruncatum	0	0	1
Pisidium ventricosum	2	0	0
Stylodrilus heringianus	5.68	2	11
im. tubifids w hair setae	5.68	4	3
im. tubificids w/o hair setae	55.38	15	28
Potamathrix vejdoovskyi	2.84	0	0
Spirosperma ferox	1.42	0	1
sample area code	1	1	1

Table 12: Benthic invertebrate data listing for 1991, transect 12 (Birch Cliff), 20m depth. Data are for number of individuals in three replicate samples.

Unionicola spp	1	0	0
Cura foremanii	0	2	0
Diaporeia spp	5	8	4
Gammarus fasciatus	0	4	1.33
Hyalella azteca	0	2	0
Paraclodpelma winnelli	0	2	0
Polypedilum illinoense	0	0	1.33
Potthaetia longimana	0	2	0
Micropsectra spp	1	2	6.67
Paratanytarsus spp	0	0	1.33
Heterotrissocladius changi	6	10	10.67
Pisidium ferrugineum	1	0	0
Pisidium lilljeborgi	1	0	1.33
Stylodrilus heringianus	78.72	182	46.67
im. tubificide w/o hair setae	1.64	0	1.33
Limnodrilus hoffmeisteri	1.64	0	0
sample area code	1	1	1

Table 13: Benthic invertebrate data listing for 1991, transect 13 (Guildwood), 20m depth. Data are for number of individuals in three replicate samples.

Chironomini early instar	0	1	0
Dicrotendipes spp	1	1	0
Dicrotendipes fumidus	0	1	0
Parachironomus abortivus	1	0	2
Parachironomus frequens	0	0	1
parachironomus vitiosis	0	12	0
Monodiamesa spp	1	0	0
Micropsectra spp	0	4	0
Paratanytarsus spp	0	1	0
Tanytarsus spp	0	2	2
Zavrelia spp	1	1	5
Cricotopus spp	0	0	3
Heterotrissocladius changi	7	26	34
Ablabesmyia monilis	1	4	4
Conchopelpopia spp	0	1	1
Helisoma anceps	1	0	1
Sphaerium nitidum	4	0	0
Pisidium casertanum	1	0	0
Pisidium conventus	0	3	0
Pisidium lilljeborgi	0	20	15
Stylodrilus heringianus	1	0	0
Nais communis	1	3	0
Nais variabilis	0	0	2.06
Stylaria lacustris	0	24	14.39
Vejdovskyella intermedia	1	0	20.56
sample area code	1	1	1

Table 14: Benthic invertebrate data listing for 1991, transect 14 (Whitby), 20m depth. Data are for number of individuals in three replicate samples.

Aturus spp	2	1	0
Hygrobates spp	8	3	0
Hydrolimax grissue	6	5	0
Diaporeia spp	0	1	2
Hyalella azteca	0	1	0
Caecidotea spp	0	1	0
Cryptochironomus spp	0	1	0
Dicrotendipes spp	2	0	0
Microtendipes spp	2	0	0
Parachironomus abortivus	2	0	0
Paraclodpelma winnelli	4	0	0
Polypedilum laetum	6	0	4
Monodiamesa spp	4	0	0
Micropsectra spp	10	5	10
Paratanytarsus spp	2	0	0
Tanytarsus spp	4	5	2
Cricotopus spp	4	0	0
Cricotopus curtus	6	0	0
Heterotrissocladius changi	88	41	96
Ablabesmyia spp	0	1	0
Ablabesmyia monilis	4	0	0
Pisidium casertanum	362	94	116
Pisidium conventus	36	32	36
Pisidium henslowanum	6	3	0
Pisidium lilljeborgi	86	18	12
Pisidium nitidum	0	0	4
Stylodrilus heringianus	32	24.65	26
Stylaria lacustris	2	1.03	0
Vejdovskyella intermedia	22	9.24	16
im. tubifids w hair setae	2	1.03	0
im. tubificids w/o hair setae	4	2.05	4
sample area code	2	2	2

Table 15: Benthic invertebrate data listing for 1991, transect 15 (Newcastle), 20m depth. Data are for number of individuals in three replicate samples.

Hydroptila spp	1	0	0
Aturus spp	0	1	0
Hygrobates spp	1	0	4
Piona spp	11	0	3
Hydridae spp	6	0	30
Hydrolimax grissue	4	0	3
Hyalella azteca	3	2	1
Caecidotea spp	1	4	4
Dicrotendipes spp	2	0	0
Microtendipes spp	2	0	0
Paracladopelma spp	1	0	0
Phaenopsectra spp	4	0	0
Polypedilum laetum	1	0	0
Cladotanytarsus spp	1	0	0
Micropsectra spp	1	0	3
Tanytarsus spp	2	2	0
Zavrelia spp	2	0	0
Heterotrissocladius changi	2	1	2
Ablabesmyia monilis	0	1	1
Conchopelpopia spp	0	2	1
Procladius spp	0	1	0
Stylodrilus heringianus	10.2	11	1.03
Slavina appendiculata	1.02	1	3.09
Stylaria lacustris	5.1	0	4.11
Vejdovskyella intermedia	24.48	1	2.06
im. tubifids w hair setae	4.08	13	7.2
im. tubificids w/o hair setae	4.08	2	9.26
Limnodrilus hoffmeisteri	1.02	0	2.06
Potamathrix moldaviensis	0	0	1.03
Potamathrix vejdoovskyi	1.02	3	4.11
Spirosperma ferox	0	0	1.03
Tasserkidrilus superiorensis	0	0	1.03
sample area code	1	1	1

Table 16: Benthic invertebrate data listing for 1991, transect 16 (Port Hope), 20m depth. Data are for number of individuals in three replicate samples.

Mystacides sepulchralis	1	0	0
Hygrobates spp	0	0	6
Piona spp	15	12	8
Hydrolimax grissue	1	0	0
Diaporeia spp	3	0	4
Gammarus fasciatus	0	8	10
Hyalella azteca	1	4	8
Helobdella stagnalis	0	0	2
Chironomus anthracinus	0	4	0
Cryptochironomus spp	6	8	0
Microtendipes spp	0	4	0
Paracladopelma nereis	0	12	0
Phaenopsectra obediens	1	0	0
Polypedilum laetum	5	0	0
Stictochironomus spp	0	8	0
Monodiamesa depectinata	0	4	0
Cladotanytarsus spp	0	12	0
Cladotanytarsus muricatus	0	4	0
Micropsectra spp	14	0	0
Stempellina bausei	3	48	0
Tanytarsus spp	3	92	0
Zavrelia spp	0	16	0
Heterotriesocladius changi	6	48	0
Amnicola limosa	0	0	6
Physella gyrina	1	0	0
Valvata tricarinata	0	0	4
Sphaerium striatinum	0	0	2
Pisidium casertanum	4	16	12
Pisidium conventus	1	0	0
Pisidium lilljeborgi	0	0	4
Stylodrilus heringianus	0	8	4
Vejdovskyella intermedia	109.98	40	2
im. tubifids w hair setae	4.68	4	0
im. tubificids w/o hair setae	2.34	124	0
sample area code	1	1	1

Table 17: Benthic invertebrate data listing for 1991, transect 17 (Cobourg), 20m depth. Data are for number of individuals in three replicate samples.

Hydroptila spp	4	0	0
Mystacides sepulchralis	12	0	0
Aturus spp	0	4	0
Hygrobates spp	40	20	32
Mideopsis spp	8	0	8
Piona spp	28	48	84
Unionicola spp	0	0	4
Porohmannella spp	0	4	0
Hydrolimax grissue	24	32	20
Diaporeia spp	4	0	0
Gammarus fasciatus	0	4	0
Caecidotea spp	16	20	52
Chironomini early instar	4	0	0
Microtendipes spp	0	4	0
Polypedilum laetum	0	4	8
Diamesinae spp	0	4	0
Cladotanytarsus spp	0	4	0
Micropsectra spp	24	28	20
Stempellina bausei	0	0	4
Tanytarsus spp	0	0	4
Zavrelia spp	40	36	40
Cricotopus spp	0	8	0
Heterotrissocladius changi	8	20	16
Psectrocladius spp	0	8	0
Ablabesmyia monilis	4	12	8
Procladius spp	0	0	4
Fossaria obrussa	12	0	0
Gyraulus deflectus	0	0	4
Physella integra	0	20	48
Pleurocera acuta	4	0	0
Valvata piscinalis	4	0	0
Sphaerium nitidum	128	108	108
Pisidium casertanum	188	188	88
Pisidium ferrugineum	8	0	0
Pisidium lilljeborgi	20	44	0
Pisidium nitidum	8	0	0
Stylodrilus heringianus	21.6	14.08	21.6
Slavina appendiculata	8.64	21.12	0
Stylaria lacustris	4.32	0	7.2
Vejdovskyella intermedia	155.52	253.44	201.6
im. tubifide w hair setae	8.64	0	14.4
im. tubificids w/o hair setae	12.96	14.08	57.6
Limnodrilus hoffmeisteri	0	7.04	7.2
Potamathrix vejdoovskyi	4.32	0	21.6
Spirosperma ferox	0	42.24	28.8
sample area code	1	1	1

Table 18: Benthic invertebrate data listing for 1991, transect 18 (Presqu'ile), 20m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	2	6	0
Piona spp	10	6	0
Crangonyx spp	2	0	0
Caecidotea spp	12	6	0
Microtendipes spp	2	0	0
Micropsectra spp	2	0	0
Amnicola limosa	0	0	2
Physella gyrina	0	2	2
Pisidium casertanum	48	46	18
Stylodrilus heringianus	0	4	8
Nais pseudobtusa	7.84	0	0
Nais variabilis	0	2	2
Slavina appendiculata	78.4	20	14
Stylaria lacustris	54.88	20	24
Uncinais uncinata	0	0	2
Vejdovskyella intermedia	227.36	44	36
im. tubifids w hair setae	15.68	2	2
im. tubificids w/o hair setae	7.84	0	0
Spirosperma ferox	0	2	0
sample area code	1	1	1

Table 19: Benthic invertebrate data listing for 1991, transect 19 (Robinson Point), 20m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	0	4	4
Piona spp	12	8	8
Unionicola spp	0	4	0
Hydrolimax grissue	0	4	0
Diaporeia spp	24	8	4
Gammarus fasciatus	16	0	4
Hyalella azteca	52	0	8
Chironomini early instar	4	0	0
Chironomus anthracinus	4	8	4
Chironomus salinarius	0	0	8
Cryptochironomus spp	16	4	4
Microtendipes spp	8	0	16
Nilothauma babiyi	0	4	0
Paraclodpelma winnelli	8	4	0
Paralauterborniella spp	8	0	0
Paratendipes albimanus	0	0	4
Polypedilum laetum	8	0	0
Stictochironomus spp	4	0	0
Monodiamesa spp	0	0	4
Micropsectra spp	16	8	36
Tanytarsus spp	12	8	36
Heterotrissocladius changi	100	36	68
Tanypodinae	4	0	0
Procladius spp	0	0	4
Physella gyrina	8	0	0
Probythinella lacustris	8	0	0
Sphaerium nitidum	24	4	4
Pisidium henslowanum	4	0	4
Stylodrilus heringianus	8.64	0	4.21
Piguetiella michiganensis	0	7.6	0
Slavina appendiculata	4.32	22.8	0
Vejdovskyella intermedia	142.56	182.4	25.26
im. tubifids w hair setae	30.24	53.2	21.05
im. tubificids w/o hair setae	25.92	114	29.47
Tasserkidrilus superiorensis	4.32	0	0
sample area code	1	1	1

Table 20: Benthic invertebrate data listing for 1991, transect 20 (Spencer Point), 20m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	1	1	1
Limnesia spp	1	0	0
Piona spp	0	1	0
Hydridae spp	1	0	0
Hydrolimax grissue	3	1	0
Procotyla fluviatilis	7	4	2
Diaporeia spp	153	53	139
Gammarus fasciatus	0	3	2
Hyalella azteca	7	14	3
Helobdella stagnalis	1	0	0
Cryptochironomus spp	1	0	0
Dicrotendipes spp	2	0	0
Microtendipes spp	1	0	2
Polypedilum laetum	3	0	1
Pseudochironomus spp	0	1	0
Monodiamesa spp	1	0	0
Potthastia spp	1	0	0
Potthastia longimana	1	0	0
Micropsectra spp	1	0	0
Zavrelia spp	0	0	1
Heterotrissocladius changi	2	0	2
Conchopelpopia spp	4	6	3
Helisoma anceps	0	1	1
Physella gyrina	5	3	4
Valvata sincera	8	1	3
Valvata tricarinata	1	1	1
Sphaerium nitidum	16	8	9
Pisidium casertanum	71	36	48
Pisidium henslowanum	2	3	3
Pisidium lilljeborgi	16	6	3
Pisidium nitidum	5	2	1
Pisidium subtruncatum	0	1	0
Stylodrilus heringianus	34.68	27.2	46.4
Vejdovskyella intermedia	14.28	8	0
im. tubifids w hair setae	10.2	6.4	1.6
im. tubificids w/o hair setae	14.28	9.6	0
Isochaetes curvisetosus	2.04	3.2	0
Limnodrilus hoffmeisteri	0	3.2	1.6
Spirosperma ferox	26.52	22.4	30.4
sample area code	1	1	1

Table 21: Benthic invertebrate data listing for 1991, transect 21 (Outlet Beach), 20m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	0	1	0
Lebertia spp	0	1	0
Limnesia spp	0	1	0
Piona spp	2	1	0
Helobdella stagnalis	0	2	0
Chironomus anthracinus	0	1	1
Cryptochironomus spp	0	0	1
Stictochironomus spp	1	0	0
Monodiamesa spp	0	1	0
Micropsectra spp	1	3	1
Tanytarsus spp	0	2	0
Heterotrissocladius changi	1	0	0
Psectrocladius spp	0	1	0
Physella gyrina	1	0	1
Valvata sincera	2	11	8
Valvata tricarinata	1	3	1
Sphaerium nitidum	2	5	1
Sphaerium striatinum	0	2	0
Pisidium casertanum	35	76	69
Pisidium henslowanum	0	2	3
Pisidium lilljeborgi	10	11	7
Pisidium ventricosum	0	0	2
Stylodrilus heringianus	29.52	45.6	31.28
Vejdovskyella intermedia	1.64	4.56	2.72
im. tubifide w hair setae	11.48	20.52	6.8
im. tubificids w/o hair setae	14.76	31.92	17.68
Isochaetes curvisetosus	1.64	0	0
Isochaetes freyi	0	2.28	0
Limnodrilus hoffmeisteri	9.84	0	0
Potamathrix vejdoovskyi	0	2.28	0
Spirosperma ferox	13.12	4.56	9.52
Tasserkidrilus superiorensis	0	2.28	0
sample area code	1	1	1

Table 22: Benthic invertebrate data listing for 1991, transect 22 (Ostrander Point), 20m depth. Data are for number of individuals in three replicate samples.

Hygrobates spp	7	14	9
Lebertia spp	0	8	8
Mideopsis spp	0	0	1
Piona spp	11	2	4
Sperchonopsis spp	0	0	1
Unionicola spp	0	1	0
Porohmannella spp	1	0	2
Hydrolimax grissue	9	6	8
Gammarus fasciatus	1	0	5
Hyalella azteca	1	0	0
Caecidotea spp	4	6	15
Chironomus spp	1	0	0
Micropsectra spp	1	0	0
Tanytarsus spp	6	4	7
Pseudosmittia spp	0	0	1
Procladius spp	2	3	1
Stagnicola catascopium	13	0	0
Sphaerium striatinum	1	0	0
Pisidium casertanum	6	16	10
Manayunkia speciosa	0	0	1
Stylodrilus heringianus	1.04	0	2
Nais communis	0	0	2
Nais variabilis	0	1.4	0
Slavina appendiculata	10.4	1.44	2
Specaria josinae	1.04	0	0
Vejdovskyella intermedia	3.12	0	1
im. tubifids w hair setae	19.76	28.8	12
im. tubificids w/o hair setae	11.44	21.6	5
Isochaetes freyi	0	4.32	0
Potamathrix vejdoovskyi	2.08	5.76	0
Spirosperma ferox	2.08	8.64	6
Tubifex embryos	1.04	0	0
sample area code	2	2	2

Table 23: Benthic invertebrate data listing for 1991, transect 23 (Prince Edward Point), 20m depth. Data are for number of individuals in three replicate samples.

Psychomiidae	0	2	0
Limnesia spp	0	1	0
Hydrolimax grissue	0	1	1
Dugesia tigrina	0	1	0
Diaporeia spp	14	0	0
Caecidotea spp	16	0	6
Chironomus salinarius	0	0	1
Cryptochironomus spp	0	0	1
Stictochironomus spp	2	0	0
Procladius spp	6	1	3
Valvata tricarinata	0	0	1
Sphaerium striatinum	2	0	0
Pisidium casertanum	6	1	1
Pisidium subtruncatum	0	0	2
Pisidium ventricosum	0	0	1
Nais simplex	2	0	0
Slavina appendiculata	0	1	0
Vejdovskyella intermedia	2	3	27.6
im. tubifids w hair setae	34	16	62.1
im. tubificids w/o hair setae	4	0	6.9
Aulodrilus pluriseta	12	0	6.9
Potamathrix bedoti	0	2	0
Potamathrix vejdoovskyi	0	0	2.3
Spirosperma ferox	24	1	9.2
Tubifex embryos	0	1	0
sample area code	1	1	1

Table 24: Benthic invertebrate data listing for 1991, transect 24 (Prince Edward Bay), 20m depth. Data are for number of individuals in three replicate samples.

Diaporeia spp	20	4	17
Gammarus fasciatus	0	0	2
Caecidotea spp	1	2	4
Tanytarsus spp	0	1	0
Helisoma anceps	1	0	0
Pisidium casertanum	1	0	4
Pisidium lilljeborgi	0	0	2
Slavina appendiculata	0	0	2
Vejdovskyella intermedia	0	1	2
im. tubifids w hair setae	1	1	6
im. tubificids w/o hair setae	3	1	3
Limnodrilus hoffmeisteri	0	1	0
Spirosperma ferox	8	11	2
sample area code	1	1	1

Table 25: Benthic invertebrate data listing for 1991, transect 25 (Amherst Island), 20m depth. Data are for number of individuals in three replicate samples.

Arrenurus spp	0	4	0
Hygrobates spp	4	6	0
Limnesia spp	0	6	0
Piona spp	24	4	0
Unionicola spp	4	0	0
Hydrolimax grissue	4	16	0
Diaporeia spp	4	20	72
Gammarus fasciatus	16	8	12
Caecidotea spp	0	0	4
Helisoma anceps	12	8	0
Marstonia decepta	4	0	0
Valvata sincera	8	12	0
Sphaerium nitidum	4	2	0
Pisidium casertanum	4	2	0
Pisidium lilljeborgi	8	24	8
Manayunkia speciosa	4	2	4
Stylodrilus heringianus	12	22	8
Uncinais uncinata	4	16	0
Vejdovskyella intermedia	4	6	0
im. tubificids w/o hair setae	40	10	28
Isochaetes freyi	4	4	4
Potamathrix moldaviensis	0	2	0
Spirosperma ferox	0	4	12
sample area code	1	1	1

APPENDIX D

RESULTS OF POWER ANALYSIS AND DATE EFFECTS

APPENDIX D. RESULTS OF POWER ANALYSIS AND POWER CURVES FOR DATE EFFECTS

Power analysis was conducted to determine the number of transects that would be needed to detect changes in the mean density of major taxa of varying magnitudes among sampling dates (i.e., how many transects would be needed to detect a change in the number of tubificids in Lake Ontario from one sampling period to the another?). Modifications of the equations described in Zar (1984) were used to calculate the magnitude of differences that would be detected as significant. Using Zar's figure B.1a, with degrees of freedom for date ($v_1=1$) and Transect ($v_2=24$) effects (for testing DATE with DATE·TRANSECT as error), and with Type I (α) and Type II (β) error probabilities set to 0.05, the non-centrality parameter Φ was 2.7. Since there were two groups in this study (1981, 1991) and 25 transects, the number of groups k' = 2 and the number of replications per group (Transects) n' was 25. The detectable difference (δ) was therefore,

$$\delta = \sqrt{\frac{2 \bullet \underline{K}' \bullet \underline{S}^2 \bullet \theta^2}{\underline{n}'}} = \sqrt{\frac{2 \bullet 2 \bullet \underline{S}^2 \bullet 2.7^2}{25}} = 1.08\underline{S}$$

where s = the square root of the mean squared error for the YEAR·TRANSECT term.

The table below summarizes the effects sizes that can be detected using 25 transects. Effect sizes were also divided by the grand mean density to give an estimate of the relative changes that can be detected with 25 transects.

Table D.1. Effect sizes and relative effect sizes that can be detected using 25 transects when differences between two years are of interest.

Taxon	Detectable Effect Size (# m^{-2})	Relative Detectable Effect Size
Lumbriculidae	5252	4.46
Naididae	40407	4.29
Tubificidae	45819	4.82
Enchytraeidae	320	9.99
Polychaeta	168	10.49
Nemertea	283	7.84
Isopoda	2076	4.50
Amphipoda	23661	5.04
Ephemeroptera	753	13.6
Trichoptera	1033	4.96
Tanypodinae	1401	3.87
Diamesinae	301	5.57
Orthocladiinae	4745	4.87
Chironomini	20939	5.11
Tanytarsini	12258	7.42
Gastropoda	13475	4.79
Sphaeriidae	8506	3.17

APPENDIX E

DETAILED OUTPUT FROM CORRESPONDENCE ANALYSIS ON THE MEIO-SCALE BENTHIC DATA FROM LAKE ONTARIO - 1981 AND 1991

APPENDIX E - DETAILED OUTPUT FROM CORRESPONDENCE ANALYSIS ON THE MEIO-SCALE BENTHIC DATA FROM LAKE ONTARIO - 1981 AND 1991

Printouts are provided for the taxa and sample scores and contributions to the axes, and the correlations between the taxa and samples with the axes. Samples are identified by Transect numbers, Depths (m) and Years the samples were collected from.

Sample Scores - Meiobenthos Data

Transect	Year	Depth	CA1	CA2	CA3
1	81	5	0.820	-0.061	-0.782
1	81	20	-0.248	-0.316	0.284
1	91	5	1.253	-0.301	-0.728
1	91	20	0.416	-1.105	0.231
2	81	5	0.631	0.269	-0.001
2	81	20	-0.314	-0.589	0.132
2	91	5	0.477	-0.245	-0.861
2	91	20	0.160	-1.652	0.979
3	81	5	-0.324	0.515	0.018
3	81	20	0.263	0.427	0.620
3	91	5	1.057	-0.216	-1.129
3	91	20	-0.086	-1.119	0.506
4	81	5	0.057	0.504	-0.662
4	81	20	-0.516	0.742	-0.418
4	91	5	0.992	-0.572	-0.971
4	91	20	-0.105	-1.504	0.909
5	81	5	-0.758	-0.347	0.098
5	81	20	0.496	-0.688	0.133
5	91	5	0.900	-0.219	-1.058
5	91	20	-0.122	-1.178	0.682
6	81	5	-0.682	0.709	-0.435
6	81	20	-0.260	-0.675	0.213
6	91	5	-0.472	-0.374	0.411
6	91	20	-0.407	-1.104	0.525
7	81	5	-0.219	0.568	-0.468
7	81	20	-0.546	0.684	-0.316
7	91	5	0.511	0.035	-0.488
7	91	20	-0.323	-0.742	0.169
8	81	5	-0.455	0.829	-0.387
8	81	20	-0.909	-0.269	-0.159
8	91	5	0.207	0.752	0.035
8	91	20	-0.703	-0.780	0.092
9	81	5	-0.657	0.284	-0.303
9	81	20	-0.386	0.361	-0.525
9	91	5	0.917	0.060	-0.252
9	91	20	-0.741	-0.721	0.145
10	81	5	-0.892	-0.413	-0.129
10	81	20	-0.901	-0.689	-0.013
10	91	5	0.632	-0.284	-0.690
10	91	20	0.159	-1.056	0.855
11	81	5	-0.727	0.850	-0.572
11	91	5	-0.258	-0.071	0.297
11	91	20	-0.559	-0.963	0.306
12	81	5	-0.713	0.952	-0.526
12	81	20	0.920	-0.687	0.206
12	91	5	-0.411	0.066	0.391
12	91	20	0.519	-1.751	1.811
13	81	5	-0.736	0.760	-0.448
13	81	20	-0.622	0.503	-0.324
13	91	5	-0.269	0.921	0.126
13	91	20	0.257	0.814	0.724

Transect	Year	Depth	CA1	CA2	CA3
14	81	5	-0.579	0.792	-0.429
14	81	20	-0.696	0.698	-0.406
14	91	5	0.524	0.397	0.360
14	91	20	0.280	-0.214	0.873
15	81	5	-0.584	0.378	-0.342
15	81	20	-0.436	0.216	-0.034
15	91	5	0.445	0.644	0.705
15	91	20	-0.165	-0.046	0.452
16	81	5	-0.473	0.694	-0.065
16	81	20	-0.592	0.712	-0.267
16	91	5	0.650	1.028	1.047
16	91	20	0.215	0.653	0.742
17	81	5	-0.429	0.494	-0.297
17	81	20	0.315	0.578	0.602
17	91	5	0.914	0.330	0.172
17	91	20	0.010	-0.003	0.320
18	81	5	0.436	0.753	0.827
18	81	20	0.810	-0.590	0.159
18	91	5	1.015	0.046	0.167
18	91	20	-0.586	0.445	-0.361
19	81	5	0.162	0.876	0.107
19	81	20	0.519	0.419	0.881
19	91	5	1.319	-0.116	-1.018
19	91	20	0.052	0.577	0.451
20	81	5	0.310	0.535	-0.654
20	81	20	0.091	-0.905	0.548
20	91	5	1.359	-0.139	-0.984
20	91	20	0.522	-0.772	0.295
21	81	5	-0.459	0.062	-0.030
21	81	20	0.190	-0.714	0.316
21	91	5	0.365	-0.141	0.367
21	91	20	-0.039	-1.148	0.628
22	81	5	0.881	-0.090	-0.566
22	81	20	-0.364	0.240	0.252
22	91	5	1.296	-0.027	-0.605
22	91	20	-0.221	-0.301	0.171
23	81	5	-0.588	-0.650	-0.162
23	81	20	-0.657	-0.358	-0.034
23	91	5	1.290	-0.378	-1.517
23	91	20	-0.573	-0.414	-0.007
24	81	5	1.386	-0.463	-1.452
24	81	20	0.378	-0.228	-0.025
24	91	5	0.672	0.225	0.339
24	91	20	0.222	-0.499	-0.072
25	81	5	1.295	-0.247	-1.202
25	81	20	-0.343	-0.589	0.171
25	91	5	0.509	-0.548	-0.122
25	91	20	0.378	-0.738	-0.104

Taxa Scores - Meiobenthos Data

Taxon	CA1	CA2	CA3
Ephemeroptera	0.989037	1.322677	1.458440
Trichoptera	0.879014	0.002822	-1.142609
Gastropoda	1.269001	-0.258863	-1.155497
Dreissendae	1.260102	-0.476623	-1.403245
Nemertea	-0.588782	0.891559	-0.488778
Chironomini	0.443822	0.707072	0.682455
Diamesinae	-0.008555	0.526493	0.288361
Tanytarsini	0.615419	0.812544	0.978239
Orthocladiinae	0.380079	0.777380	0.578335
Tanypodinae	0.229071	0.312510	0.256168
Enchytraeidae	0.777793	-0.087040	0.324124
Naididae	-0.577839	0.565049	-0.358081
Isopoda	0.426031	-0.143554	-0.050151
Amphipoda	0.929853	-0.251601	-0.116680
Sphaeriidae	0.079044	-0.644172	0.339663
Polychaeta	1.045487	-0.485980	-1.479569
Lumbriculidae	0.321794	-1,626901	1.181374
Tubificidae	-0.730331	-0.504956	0.006937

Sample Contributions - Meiobenthos Data

Transect	Year	Depth	CA1	CA2	CA3
1	81	5	0.820208	-0.060825	-0.782398
1	81	20	-0.248174	-0.316225	0.283871
1	91	5	1.253295	-0.300937	-0.727884
1	91	20	0.416292	-1.105222	0.231251
2	81	5	0.631386	0.268635	-0.000913
2	81	20	-0.313853	-0.589317	0.132355
2	91	5	0.477238	-0.245448	-0.860817
2	91	20	0.160413	-1.652316	0.978920
3	81	5	-0.324297	0.515177	0.017911
3	81	20	0.263078	0.427099	0.620137
3	91	5	1.056575	-0.215826	-1.129314
3	91	20	-0.085533	-1.119102	0.506498
4	81	5	0.056543	0.504124	-0.661749
4	81	20	-0.516339	0.742132	-0.417527
4	91	5	0.992296	-0.572045	-0.970599
4	91	20	-0.105366	-1.503527	0.908705
5	81	5	-0.757616	-0.346640	0.097655
5	81	20	0.495943	-0.688033	0.132739
5	91	5	0.900200	-0.219368	-1.057600
5	91	20	-0.122410	-1.178029	0.682463
6	81	5	-0.681960	0.709020	-0.434788
6	81	20	-0.259579	-0.674843	0.212837
6	91	5	-0.472252	-0.373829	0.411464
6	91	20	-0.407114	-1.104187	0.524604
7	81	5	-0.218849	0.568373	-0.468268
7	81	20	-0.546114	0.683961	-0.315768
7	91	5	0.510892	0.034728	-0.487670
7	91	20	-0.323186	-0.742393	0.169379
8	81	5	-0.454962	0.828766	-0.386737
8	81	20	-0.909337	-0.269415	-0.158706
8	91	5	0.206540	0.752341	0.034812
8	91	20	-0.703005	-0.779691	0.092071
9	81	5	-0.657303	0.284379	-0.302980
9	81	20	-0.386140	0.361113	-0.524529
9	91	5	0.917336	0.060339	-0.252156
9	91	20	-0.740803	-0.721005	0.144914
10	81	5	-0.891588	-0.413347	-0.128710
10	81	20	-0.900780	-0.688694	-0.013066
10	91	5	0.632390	-0.283813	-0.690283
10	91	20	0.159119	-1.055611	0.854902
11	81	5	-0.727032	0.849576	-0.572036
11	91	5	-0.258472	-0.070893	0.296859
11	91	20	-0.558724	-0.962805	0.306141
12	81	5	-0.712762	0.952233	-0.525663
12	81	20	0.919697	-0.686809	0.206010
12	91	5	-0.411162	0.065503	0.391467
12	91	20	0.519350	-1.750621	1.810858
13	81	5	-0.736492	0.760054	-0.448069
13	81	20	-0.622485	0.503197	-0.323890

13	91	5	-0.268534	0.920665	0.126155
13	91	20	0.257457	0.813598	0.723693
14	81	5	-0.579161	0.792027	-0.428604
14	81	20	-0.696321	0.698395	-0.406052
14	91	5	0.523766	0.397094	0.359505
14	91	20	0.280287	-0.214405	0.873484
15	81	5	-0.584219	0.378151	-0.342058
15	81	20	-0.435925	0.216049	-0.034267
15	91	5	0.444630	0.643809	0.704964
15	91	20	-0.165275	-0.045600	0.451812
16	81	5	-0.472684	0.694100	-0.064713
16	81	20	-0.591615	0.711792	-0.267078
16	91	5	0.650162	1.027961	1.047161
16	91	20	0.214890	0.652645	0.742042
17	81	5	-0.428501	0.494160	-0.296872
17	81	20	0.315008	0.578495	0.601540
17	91	5	0.914294	0.330005	0.171780
17	91	20	0.010065	-0.003270	0.320413
18	81	5	0.435972	0.752907	0.827465
18	81	20	0.809685	-0.590130	0.158870
18	91	5	1.014982	0.045749	0.167400
18	91	20	-0.586364	0.444620	-0.361272
19	81	5	0.161948	0.875846	0.106642
19	81	20	0.519194	0.419121	0.880923
19	91	5	1.318857	-0.116106	-1.018357
19	91	20	0.051836	0.577069	0.451386
20	81	5	0.309942	0.534529	-0.654009
20	81	20	0.090569	-0.904842	0.548476
20	91	5	1.358665	-0.138543	-0.983923
20	91	20	0.521947	-0.772086	0.294607
21	81	5	-0.458570	0.061540	-0.029821
21	81	20	0.189700	-0.714109	0.316163
21	91	5	0.364969	-0.140628	0.366939
21	91	20	-0.039151	-1.148040	0.627826
22	81	5	0.880774	-0.089593	-0.565804
22	81	20	-0.364125	0.239815	0.252446
22	91	5	1.296265	-0.027303	-0.605146
22	91	20	-0.220809	-0.301063	0.171356
23	81	5	-0.587842	-0.649875	-0.162181
23	81	20	-0.656509	-0.358461	-0.034233
23	91	5	1.290349	-0.378302	-1.516926
23	91	20	-0.572576	-0.414049	-0.007096
24	81	5	1.385680	-0.463279	-1.451685
24	81	20	0.377532	-0.228125	-0.024807
24	91	5	0.672059	0.225188	0.339028
24	91	20	0.221927	-0.498705	-0.072167
25	81	5	1.295353	-0.247439	-1.202455
25	81	20	-0.343110	-0.588818	0.171150
25	91	5	0.509186	-0.547917	-0.122411
25	91	20	0.377507	-0.738293	-0.103956

Taxa Contributions - Meiobenthos Data

Taxon	CA1	CA2	CA3
Ephemeroptera	0.002836	0.006799	0.010252
Trichoptera	0.008417	0.000000	0.023643
Gastropoda	0.237096	0.013224	0.326790
Dreissenidae	0.006365	0.001221	0.013122
Nemertea	0.000649	0.001995	0.000743
Chironomini	0.042198	0.143562	0.165865
Diamesinae	0.000000	0.001043	0.000388
Tanytarsini	0.032780	0.076595	0.137687
Orthocladiinae	0.007369	0.041320	0.028363
Tanypodinae	0.000995	0.002483	0.002069
Enchytraeidae	0.001004	0.000017	0.000290
Naididae	0.165644	0.212311	0.105744
Isopoda	0.004381	0.000667	0.000101
Amphipoda	0.215466	0.021145	0.005640
Sphaeriidae	0.000886	0.078892	0.027203
Polychaeta	0.000929	0.000269	0.003094
Lumbriculidae	0.006649	0.227796	0.148967
Tubificidae	0.266335	0.170661	0.000040

Sample Correlations - Meiobenthos Data

Transect	Year	Depth	CA1	CA2	CA3
1	81	5	0.352191	0.001937	0.320469
1	81	20	0.101915	0.165469	0.133343
1	91	5	0.467312	0.026943	0.157625
1	91	20	0.028993	0.204363	0.008947
2	81	5	0.268592	0.048621	0.000001
2	81	20	0.128460	0.452912	0.022845
2	91	5	0.004862	0.001286	0.015817
2	91	20	0.003981	0.422379	0.148255
3	81	5	0.208071	0.525097	0.000635
3	81	20	0.089273	0.235292	0.496052
3	91	5	0.408182	0.017032	0.466318
3	91	20	0.001580	0.270504	0.055410
4	81	5	0.001196	0.095075	0.163824
4	81	20	0.172151	0.355633	0.112567
4	91	5	0.361165	0.120028	0.345544
4	91	20	0.002436	0.495929	0.181152
5	81	5	0.470003	0.098392	0.007809
5	81	20	0.134330	0.258541	0.009623
5	91	5	0.284682	0.016905	0.392938
5	91	20	0.005471	0.506663	0.170045
6	81	5	0.243353	0.263049	0.098918
6	81	20	0.097002	0.655615	0.065213
6	91	5	0.192435	0.120581	0.146083
6	91	20	0.074410	0.547378	0.123556
7	81	5	0.042174	0.284463	0.193084
7	81	20	0.235748	0.369780	0.078816
7	91	5	0.282483	0.001305	0.257386
7	91	20	0.083587	0.441061	0.022959
8	81	5	0.133299	0.442325	0.096318
8	81	20	0.753909	0.066178	0.022965
8	91	5	0.023334	0.309613	0.000663
8	91	20	0.287087	0.353136	0.004924
9	81	5	0.636348	0.119113	0.135205
9	81	20	0.120990	0.105815	0.223254
9	91	5	0.525139	0.002272	0.039678
9	91	20	0.327570	0.310295	0.012535
10	81	5	0.576629	0.123936	0.012017
10	81	20	0.379272	0.221700	0.000080
10	91	5	0.234688	0.047270	0.279624
10	91	20	0.010363	0.456095	0.299144
11	81	5	0.217129	0.296494	0.134418
11	91	5	0.076530	0.005757	0.100950
11	91	20	0.197047	0.585130	0.059159
12	81	5	0.178549	0.318681	0.097115
12	81	20	0.174849	0.097509	0.008773
12	91	5	0.156184	0.003964	0.141580
12	91	20	0.016896	0.191978	0.205417
13	81	5	0.296974	0.316279	0.109919
13	81	20	0.217450	0.142095	0.058870

13	91	5	0.053011	0.623123	0.011700
13	91	20	0.025374	0.253399	0.200490
14	81	5	0.189672	0.354719	0.103876
14	81	20	0.287770	0.289486	0.097856
14	91	5	0.250524	0.143999	0.118028
14	91	20	0.018349	0.010737	0.178205
15	81	5	0.441756	0.185081	0.151437
15	81	20	0.151067	0.037107	0.000933
15	91	5	0.102778	0.215485	0.258368
15	91	20	0.040929	0.003116	0.305871
16	81	5	0.245925	0.530279	0.004609
16	81	20	0.239579	0.346798	0.048825
16	91	5	0.143469	0.358646	0.372169
16	91	20	0.035059	0.323391	0.418053
17	81	5	0.120791	0.160645	0.057979
17	81	20	0.063110	0.212839	0.230134
17	91	5	0.751371	0.097887	0.026523
17	91	20	0.000075	0.000008	0.076375
18	81	5	0.067948	0.202648	0.244771
18	81	20	0.242845	0.129001	0.009349
18	91	5	0.702266	0.001427	0.019103
18	91	20	0.208021	0.119606	0.078966
19	81	5	0.012972	0.379422	0.005625
19	81	20	0.143258	0.093355	0.412415
19	91	5	0.493405	0.003824	0.294177
19	91	20	0.003132	0.388105	0.237459
20	81	5	0.081853	0.243453	0.364451
20	81	20	0.003764	0.375660	0.138027
20	91	5	0.535735	0.005570	0.280962
20	91	20	0.167270	0.366014	0.053291
21	81	5	0.281012	0.005061	0.001188
21	81	20	0.022159	0.314004	0.061550
21	91	5	0.060905	0.009042	0.061565
21	91	20	0.000505	0.434628	0.129982
22	81	5	0.237295	0.002455	0.097924
22	81	20	0.270380	0.117280	0.129960
22	91	5	0.684645	0.000304	0.149210
22	91	20	0.049726	0.092441	0.029947
23	81	5	0.244299	0.298580	0.018595
23	81	20	0.577590	0.172196	0.001570
23	91	5	0.194584	0.016725	0.268918
23	91	20	0.255931	0.133832	0.000039
24	81	5	0.298427	0.033358	0.327535
24	81	20	0.078315	0.028594	0.000338
24	91	5	0.319104	0.035827	0.081206
24	91	20	0.034067	0.172028	0.003602
25	81	5	0.457374	0.016689	0.394124
25	81	20	0.102296	0.301269	0.025453
25	91	5	0.115623	0.133882	0.006682
25	91	20	0.068053	0.260288	0.005161

Taxa Correlations - Meiobenthos Data

Taxon	CA1	CA2	CA3
Ephemeroptera	0.095295	0.170433	0.207216
Trichoptera	0.073570	0.000001	0.124310
Gastropoda	0.435779	0.018134	0.361310
Dreissenidae	0.030050	0.004299	0.037266
Nemertea	0.026840	0.061542	0.018497
Chironomini	0.147885	0.375348	0.349667
Diamesinae	0.000018	0.066399	0.019918
Tanytarsini	0.147844	0.257723	0.373551
Orthocladiinae	0.074012	0.309615	0.171362
Tanypodinae	0.029593	0.055078	0.037008
Enchytraeidae	0.030220	0.000378	0.005248
Naididae	0.317175	0.303290	0.121800
Isopoda	0.054937	0.006238	0.000761
Amphipoda	0.453331	0.033190	0.007138
Sphaeriidae	0.003153	0.209385	0.058215
Polychaeta	0.026676	0.005764	0.053426
Lumbriculidae	0.013308	0.340158	0.179364
Tubificidae	0.482253	0.230538	0.000044

APPENDIX F

RAW MACRO-SCALE BIVALVE DATA FROM LAKE ONTARIO - 1991

APPENDIX F

RAW MACRO-SCALE BIVALVE DATA FROM LAKE ONTARIO - 1991

This appendix includes data for the macrobenthic component of the 1991 survey of Lake Ontario. Copies of 1991 data are available as ascii data files or Lotus spreadsheets files from Todd Howell (MOEE), or Bruce Kilgour (WSA).

Table 1. Numbers of bivalves at Transect 1 (Niagara-on-the-Lake), 5 m depth. Data are number of individuals in five replicate samples

D. polymopha	1705	1423	1881	1449	1192
S. striatinum	0	8	7	1	6
P. amnicum	0	0	0	0	0
P. casertanum	0	0	4	5	0
P. compressum	0	4	5	2	0
P. fallax	0	4	0	0	1
P. hensowanum	0	1	0	0	0
P. punctatum	0	0	2	2	0
Area Sampled (sq cm)	625	625	625	625	625

Table 2. Numbers of bivalves at Transect 2 (Port Dalhousie), 5 m depth. Data are for number of individuals in five replicate samples

D. polymopha	371	2006	1006	2685	2244
P. compressum	0	0	0	0	1
Area Sampled (sq cm)	900	900	900	900	900

Table 3. Numbers of bivalves at Transect 3 (Jordan Harbour), 5 m depth. Data are for number of individuals in five replicate samples

D. polymopha	1768	471	367	949	581
S. nitidum	0	0	0	1	1
S. striatinum	0	0	0	1	0
P. compressum	0	0	0	1	0
P. fallax	0	0	0	0	2
P. hensowanum	0	0	0	1	0
Area Sampled (sq cm)	925	925	925	925	925

Table 4. Numbers of bivalves at Transect 4 (Beamsville), 5 m depth. Data are for number of individuals in five replicate samples

D. polymopha	185	128	192	181	200
M. transversum	0	0	0	1	0
S. nitidum	10	4	13	8	3
S. striatinum	3	9	3	2	6
P. amnicum	1	1	0	0	0
P. casertanum	4	5	5	1	0
P. compressum	4	5	4	2	0
P. fallax	4	4	7	18	0
P. ferrugineum	1	0	0	0	0
P. hensowanum	5	0	4	2	0
P. lilljeborgi	0	0	1	0	0
P. lilljeborgi f. cristatum	0	2	0	0	0
P. nitidum	1	0	2	0	0
P. punctatum	0	3	0	2	0
P. subtruncatum	0	0	1	0	0
Unionidae	0	1	0	0	0
Area Sampled (sq cm)	625	625	625	625	625

Table 5. Numbers of bivalves at Transect 5 (Stoney Creek), 5 m depth. Data are for number of individuals in five replicate samples

D. polymopha	59	48	52	44	29
Area Sampled (sq cm)	625	625	625	625	

Table 6. Numbers of bivalves at Transect 7 (Bronte), 5 m depth. Data are for number of individuals in five replicate samples

D. polymopha	81	70	76	48	107
S. striatinum	1	0	0	0	0
P. fallax	1	0	0	0	0
Area Sampled (sq cm)	1250	1250	1250	1250	1250

Table 7. Numbers of bivalves at Transect 8 (Oakville), 5 m depth. Data are for number of individuals in five replicate samples.

D. polymopha	53	14	11	22	10
Area Sampled (sq cm)	10000	625	625	625	625

Table 8. Numbers of bivalves at Transect 9 (Etobicoke), 5 m depth. Data are for number of individuals in five replicate samples

D. polymopha	83	99	137	94	102
S. nitidum	0	1	0	0	0
S. striatinum	0	2	0	0	0
Area Sampled (sq cm)	625	625	625	625	625

APPENDIX G

DETAILED OUTPUT FROM CORRESPONDENCE ANALYSIS ON THE MACRO-SCALE BIVALVE DATA FROM LAKE ONTARIO - 1991

APPENDIX G - DETAILED OUTPUT FROM CORRESPONDENCE ANALYSIS ON THE MACRO-SCALE BIVALVE DATA FROM LAKE ONTARIO - 1991

Printouts are provided for the taxa and sample scores and contributions to the axes, and the correlations between the taxa and samples with the axes. Samples are identified by the Transect numbers the bivalve samples were collected from.

Sample Scores - Bivalve Data

Transect	CA1	CA2	CA3
1	0.103245	0.015660	0.003780
1	0.017857	-0.019266	0.022656
1	0.041358	-0.050345	-0.011251
1	0.052293	-0.030957	-0.010825
1	0.070277	-0.017165	0.008466
2	0.103245	0.015660	0.003780
2	0.104080	0.017991	0.001219
2	0.103245	0.015660	0.003780
2	0.103867	0.017396	0.001873
2	0.101128	0.016554	-0.000894
3	0.104459	0.019051	0.000056
3	0.103245	0.015660	0.003780
3	0.103245	0.015660	0.003780
3	0.067000	0.018422	-0.015625
3	0.045786	0.041889	0.045023
4	-1.398794	0.283981	-0.630044
4	-1.686984	-1.752182	0.066524
4	-1.647156	0.578148	-0.603457
4	-1.616918	0.528518	1.171572
4	-0.202602	-0.141380	-0.089976
5	0.103245	0.015660	0.003780
5	0.103245	0.015660	0.003780
5	0.103245	0.015660	0.003780
5	0.103245	0.015660	0.003780
5	0.103245	0.015660	0.003780
7	-0.088817	-0.016001	0.164943
7	0.103245	0.015660	0.003780
7	0.103245	0.015660	0.003780
7	0.103245	0.015660	0.003780
7	0.103245	0.015660	0.003780
8	0.103245	0.015660	0.003780
8	0.103245	0.015660	0.003780
8	0.103245	0.015660	0.003780
8	0.114086	0.045940	-0.029473
8	0.103245	0.015660	0.003780
9	0.103245	0.015660	0.003780
9	-0.105650	-0.091599	-0.060256
9	0.103245	0.015660	0.003780
9	0.105783	0.022746	-0.004003
9	0.103245	0.015660	0.003780

Taxa Scores- Bivalve Data

Taxon	CA1	CA2	CA3
Dreissena polymorpha	0.035956	0.002988	0.000609
Musculium transversum	-4.642854	2.769562	7.268382
Sphaerium nitidum	-3.965764	0.922174	-0.740731
S. striatinum	-1.673428	-1.500489	-0.155133
Pisidium amnicum	-4.430286	-3.846863	-1.748026
P. casertanum	-2.806324	-0.996059	-1.068217
P. compressum	-2.450395	-0.885047	-0.511567
P. fallax	-3.806327	1.004988	2.312484
P. ferrugineum	-4.016528	1.488128	-3.908767
P. henslowanum	-3.796042	1.977648	-1.570850
P. lilljeborgi	-4.729681	3.029631	-3.743822
P. lilljeborgi f. cristatum	-4.844043	-9.181853	0.412715
P. nitidum	-4.491963	2.515796	-3.798803
P. punctatum	-2.586668	-2.539835	1.722333
P. subtruncatum	-4.729681	3.029631	-3.743822
Unionidae	-4.844043	-9.181853	0.412715
Dreissena sp (quagga mussel)	0.119013	0.130113	-0.117309

Sample Contributions- Bivalve Data

Transect	CA1	CA2	CA3
1	0.008189	0.000627	0.000051
1	0.000207	0.000802	0.001555
1	0.001464	0.007223	0.000506
1	0.001798	0.002098	0.000360
1	0.002668	0.000530	0.000181
2	0.001237	0.000095	0.000008
2	0.006779	0.000675	0.000004
2	0.003356	0.000257	0.000021
2	0.009064	0.000847	0.000014
2	0.007184	0.000641	0.000003
3	0.005848	0.000648	0.000000
3	0.001522	0.000117	0.000010
3	0.001186	0.000091	0.000007
3	0.001297	0.000327	0.000329
3	0.000371	0.001035	0.001675
4	0.192197	0.026383	0.182022
4	0.206457	0.741780	0.001499
4	0.284845	0.116876	0.178474
4	0.255634	0.090964	0.626504
4	0.003866	0.006269	0.003559
5	0.000283	0.000022	0.000002
5	0.000231	0.000018	0.000001
5	0.000250	0.000019	0.000002
5	0.000211	0.000016	0.000001
5	0.000139	0.000011	0.000001
7	0.000148	0.000016	0.002375
7	0.000168	0.000013	0.000001
7	0.000183	0.000014	0.000001
7	0.000115	0.000009	0.000001
7	0.000257	0.000020	0.000002
8	0.000016	0.000001	0.000000
8	0.000067	0.000005	0.000000
8	0.000053	0.000004	0.000000
8	0.000129	0.000070	0.000040
8	0.000048	0.000004	0.000000
9	0.000399	0.000031	0.000002
9	0.000513	0.001284	0.000779
9	0.000658	0.000050	0.000004
9	0.000474	0.000073	0.000003
9	0.000490	0.000038	0.000003

Taxa Contributions - Bivalve Data

Taxon	CA1	CA2	CA3
Dreissena polymorpha	0.010516	0.000242	0.000014
Musculium transversum	0.009713	0.011511	0.111122
Sphaerium nitidum	0.285912	0.051489	0.046563
S. striatinum	0.060785	0.162764	0.002439
Pisidium amnicum	0.017688	0.044415	0.012854
P. casertanum	0.085167	0.035733	0.057604
P. compressum	0.074043	0.032170	0.015065
P. fallax	0.260120	0.060394	0.448191
P. ferrugineum	0.007269	0.003323	0.032137
P. henslowanum	0.082284	0.074381	0.065776
P. lilljeborgi	0.010080	0.013774	0.029482
P. lilljeborgi f. cristatum	0.021146	0.253035	0.000717
P. nitidum	0.027276	0.028495	0.091063
P. punctatum	0.027134	0.087125	0.056157
P. subtruncatum	0.010080	0.013774	0.029482
Unionidae	0.010573	0.126518	0.000358
Dreissena sp. (quagga mussel)	0.000215	0.000857	0.000976

Sample Correlations - Bivalve Data

Transect	CA1	CA2	CA3
1	0.778628	0.017912	0.001044
1	0.028937	0.033681	0.046580
1	0.188130	0.278769	0.013923
1	0.223955	0.078486	0.009596
1	0.447097	0.026671	0.006489
2	0.778628	0.017912	0.001044
2	0.817310	0.024421	0.000112
2	0.778628	0.017912	0.001044
2	0.891619	0.025011	0.000290
2	0.696651	0.018668	0.000054
3	0.625051	0.020789	0.000000
3	0.778628	0.017912	0.001044
3	0.778628	0.017912	0.001044
3	0.531729	0.040198	0.028917
3	0.209256	0.175154	0.202343
4	0.684573	0.028216	0.138885
4	0.479269	0.517031	0.000745
4	0.736289	0.090710	0.098826
4	0.612182	0.065407	0.321398
4	0.122615	0.059708	0.024183
5	0.778628	0.017912	0.001044
5	0.778628	0.017912	0.001044
5	0.778628	0.017912	0.001044
5	0.778628	0.017912	0.001044
5	0.778628	0.017912	0.001044
7	0.090437	0.002935	0.311904
7	0.778628	0.017912	0.001044
7	0.778628	0.017912	0.001044
7	0.778628	0.017912	0.001044
7	0.778628	0.017912	0.001044
8	0.778628	0.017912	0.001044
8	0.778628	0.017912	0.001044
8	0.778628	0.017912	0.001044
8	0.012458	0.002020	0.000831
8	0.778628	0.017912	0.001044
9	0.778628	0.017912	0.001044
9	0.077208	0.058037	0.025115
9	0.778628	0.017912	0.001044
9	0.208579	0.009644	0.000299
9	0.778628	0.017912	0.001044

Taxa Correlations - Bivalve Data

Taxon	CA1	CA2	CA3
Dreissena polymorpha	0.987736	0.006823	0.000284
Musculium transversum	0.258702	0.092056	0.634023
Sphaerium nitidum	0.906053	0.048992	0.031610
S. striatinum	0.447409	0.359713	0.003845
Pisidium amnicum	0.405543	0.305764	0.063135
P. casertanum	0.740768	0.093320	0.107331
P. compressum	0.811433	0.105856	0.035366
P. fallax	0.693758	0.048364	0.256067
P. ferrugineum	0.194514	0.026701	0.184217
P. henslowanum	0.650557	0.176572	0.111402
P. lilljeborgi	0.288518	0.118383	0.180776
P. lilljeborgi f. cristatum	0.208290	0.748364	0.001512
P. nitidum	0.466751	0.146408	0.333815
P. punctatum	0.396199	0.381982	0.175657
P. subtruncatum	0.288518	0.118383	0.180776
Unionidae	0.208290	0.748364	0.001512
Dreissena sp. (quagga mussel)	0.008022	0.009588	0.007794

APPENDIX H

CHANGES IN COMPOSITION AND DENSITY OF BENTHIC INVERTEBRATES AT THREE TRANSECTS OVER JULY AND AUGUST 1981.

APPENDIX H

CHANGES IN COMPOSITION AND DENSITY OF BENTHIC INVERTEBRATES AT THREE TRANSECTS OVER JULY AND AUGUST 1981.

H.1 INTRODUCTION

In 1981 all transects were sampled between July 3-31. In 1991 stations were sampled up to one month latter, between August 7 and September 5. Several of the changes in composition noted between 1981-1991 may be a consequence of the difference in the timing of sample collection between years. Additional data collected in 1981 on the effects of seasonality on composition were examined to provide insight into the possible extent and nature of the between-year differences that might have occurred because of the timing of sampling. Seasonal sampling was conducted at three transects in 1981. Transect 9, 11, and 24 were sampled three times over the period between the start of the extensive sampling (early July) in 1981 and the end of sampling (late August) in 1981.

The changes over time in 1981 in the numbers of individuals among summary taxa, total numbers of individuals and numbers of taxa were assessed qualitatively by examining plots of density over time. In addition, ANOVA analysis was used to test for time-trend patterns in total numbers, richness, numbers of naidid and tubificid worms using a multivariate repeated measures design (Table 1). Transect and sampling date were treated as fixed effects. Orthogonal contrasts was used to test for linear time trend. A linear trend was considered to be the pattern of importance in relation to whether time trends would impact on the interpretation of the inter-year results. The raw data were transformed to natural logs prior to analysis. Separate analyses were used for the 5 and 20 m stations.

H.2 RICHNESS, TOTAL NUMBERS, NAIDID AND TUBIFICID WORMS

Based on the ANOVA analysis, the results for 5 m suggest possible time-trend patterns in numbers of tubificids and total numbers of individuals, however, the patterns are not easily interpreted. The time effect was significant for tubificid worms, however, the time*transect interaction was also significant indicating that the significance of the time effect was variable among stations (Table 1). Examination of the density data in Figure 1 indicates that the results are driven by transect 9 where numbers decrease greatly between early July and latter. Numbers increase slightly over time at transect 11 and are mostly unchanged over time at transect 24. The time effect in total numbers of individuals was also marginally significant, and again the time*transect interaction was significant. No clear interpretation of the pattern is evident from a review of the density data (Figure 2).

While the ANOVA analysis did not detect a significant time effect for numbers of naidids and numbers of taxa at 5 m, a decline over time in numbers of naidids and taxa was suggested by the plots of density at transect 9 (Figure 3 and 4). The pattern at other transects was not consistent with that of transect 9.

At 20 m there was a significant time effect for naidid numbers. Density was near maximum in early August, however, there is insufficient data to gauge the timing of shifts in density between early July and early August or between early August and late August (Figure 3).

Overall there was no clear pattern of change in the numbers of tubificids. There were marked changes over time at two transects, but the direction of the change was reversed between stations (Figure 1). The information is inconclusive and it does not provide a basis to either accept or reject the hypothesis that differences in sampling date prejudice the comparisons between 1981-1991.

There were changes in the numbers of naidids over the July-August interval, however, there was little consistency in the changes among transects and depth (Figure 3). Higher numbers were noted in early August at most, but not all, stations. It is possible that the differences between years may be related to sampling date, however, it not obvious whether a positive or negative bias is to be expected based on these results. It is advisable to interpret the between year changes in numbers of naidid worms with caution.

The total numbers of individuals and numbers of taxa did not vary over time in any consistent manner (Figure 2 and 4). The patterns varied among transect and depths. The data provide no basis to expect either a positive or negative bias in the comparisons between 1981 and 1981 because of the time of sampling.

H.3 OTHER SUMMARY TAXA

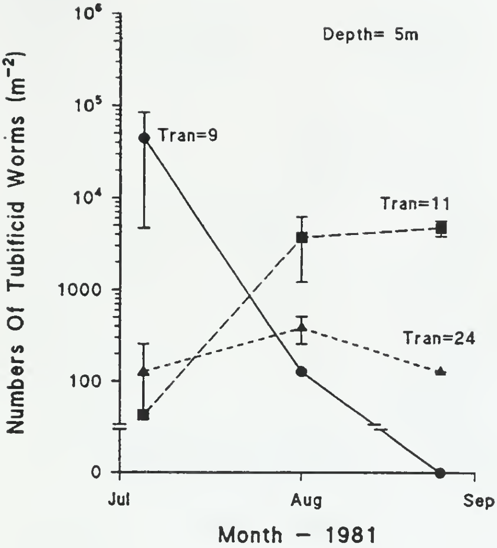
The changes in numbers over time of the summary groups which were not as abundant or well represented among stations as the naidid and ~~eared~~ tubificid worms are provided in Table 2. Except where noted below, no particular pattern of change was noted, or, the occurrence of the group was too restricted to allow interpretation.

There is some suggestion in the data that numbers of amphipods and gastropods may decrease in density from early July to late August.

Chironomids were moderately abundant at some stations in 1991 and were on average more abundant in 1991 than in 1981. Unfortunately, the 1981 trend data provides little insight into the changes in density of chironomids to be expected over the July and August period because chironomids were not abundant at the three transects surveyed in 1981, making any assessment of the pattern difficult.

H.4 CONCLUSION

The 1981 time-trend data do not provide a clear answer to the issue of whether the latter period of sampling in 1991 than in 1981 accounts for the differences in composition observed between years. There is not a strong basis to expect any particular pattern of changes for any of the variables examined. It is very clear that at some sites the estimates of many of the variables change strongly over time, however, the direction of the changes and the magnitude of the change are highly variable among stations. There is insufficient data to conclusively assess the issue. Therefore the interpretation of the changes in composition between the extensive surveys in 1981 and 1991 must be made cautiously. It should be noted that even had the timing of stations been paired perfectly, there still would be the possibility that differences composition were related to seasonality. The precise timing and the magnitude and character of seasonal changes are, to a degree variable, among years and cannot be predicted a priori.



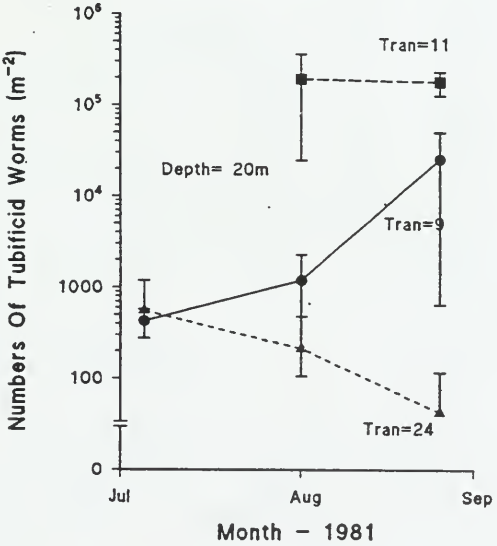


Figure H.1. Mean density of tubificid worms at 5 and 20 m depths at transects 9, 11 and 24 from July-August 1981. Results are for the geometric means of three replicate samples; error bars give 1 SD of the mean.

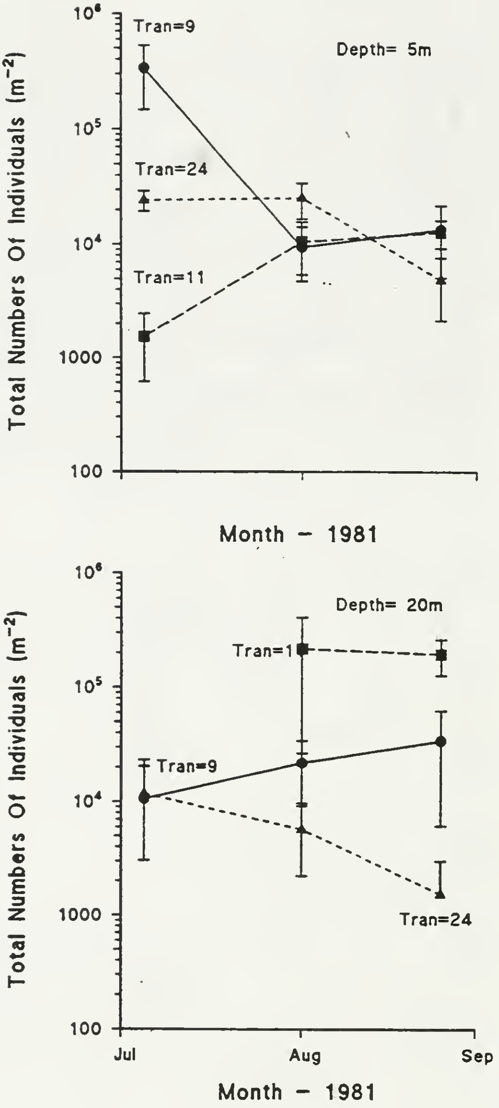


Figure H.2. Mean number of individuals at 5 and 20 m depths at transects 9, 11 and 24 from July-August 1981. Results are for the geometric means of three replicate samples; error bars give 1 SD of the mean.

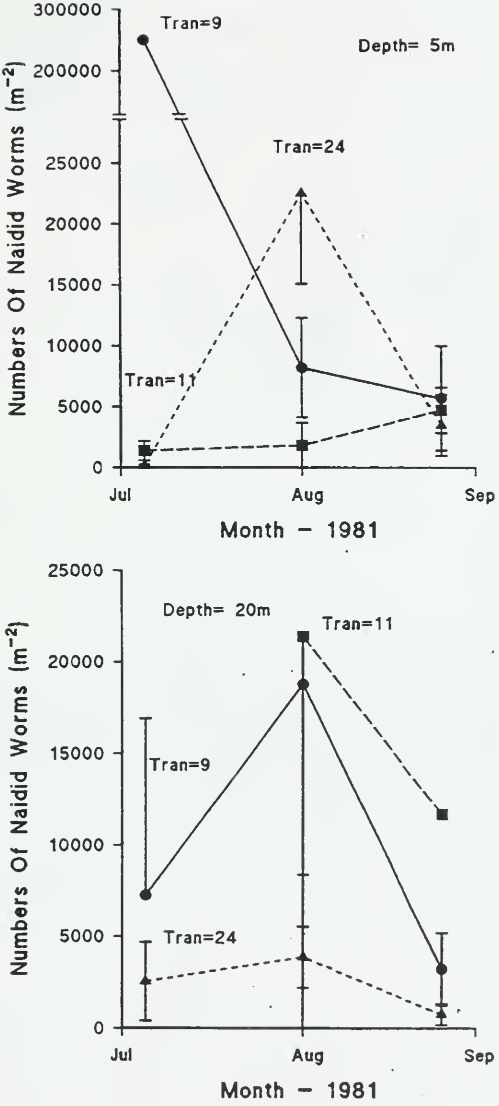


Figure H.3. Mean number of naidid worms at 5 and 20 m depths at transects 9, 11 and 24 from July-August 1981. Results are for the geometric means of three replicate samples; error bars give 1 SD of the mean.

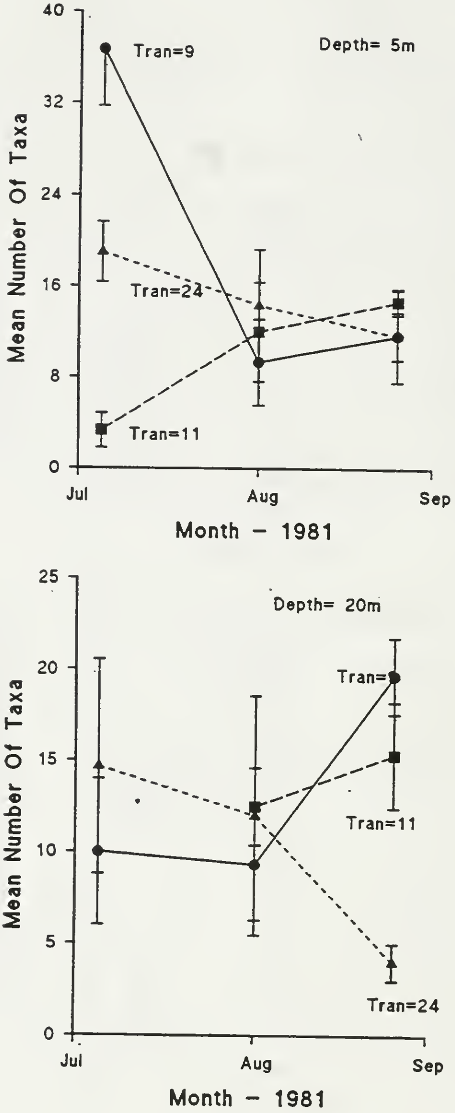


Figure H.4. Mean number of taxa at 5 and 20 m depths at transects 9, 11 and 24 from July-August 1981. Results are for the geometric means of three replicate samples; error bars give 1 SD of the mean.

Table 1: Summary results for repeated measures ANOVA for tests of seasonal effects on abundances of major taxa groups, taxa richness, and total abundance.

Variable	Significant Time Effect	Significant Time*Transect Interaction	Significant Linear Time Effect	Significant Linear Slope Differences
Five Meter Stations				
Taxa Richness	N	Y (0.002)	N	-
Total Individuals	M (0.1)	Y (0.001)	Y (0.04)	Y (0.001)
Total Naididae	N	Y (0.001)	N	-
Total Tubificidae	Y (0.002)	Y (0.002)	N	-
Twenty Meter Stations				
Taxa Richness	N	Y (0.04)	N	-
Total Individuals	N	N	N	-
Total Naididae	Y (0.01)	N	N	-
Total Tubificidae	N	M (0.06)	N	-

Notes: N, not significant at P =< 0.1; M, marginally significant; Y, significant; -, not relevent. Because of missing data for the 20 m station at transect 11, the analysis is for transect 9 and 24. Data were transformed to natural logs. The multivariate time and time*transect interaction effects based on Wilk's Lambda are reported above.

Table 2: Mean abundance per square meter for selected groups between July 5 and August 24, 1981 at the 5 and 20 m stations on transects 9, 11 and 24 (ns= no sample).

Date	Taxa	Transect	9	11	24	9	11	24
		Depth	5	5	5	20	20	20
July 5	Amphipoda		14267	42	1061	0	ns	2123
August 1	Amphipoda		297	3989	0	0	551	0
August 24	Amphipoda		679	1443	169	169	381	0
July 5	Chironomini		2929	42	42	42	ns	127
August 1	Chironomini		42	424	509	0	551	0
August 24	Chironomini		127	976	127	42	339	42
July 5	Diamesinae		552	0	0	0	ns	0
August 1	Diamesinae		42	42	0	0	0	0
August 24	Diamesinae		0	169	0	0	339	0
July 5	Orthocladiinae		5222	0	0	0	ns	0
August 1	Orthocladiinae		212	212	848	679	0	466
August 24	Orthocladiinae		424	127	466	721	0	0
July 5	Tanypodinae		3481	0	42	42	ns	1273
August 1	Tanypodinae		42	0	169	84	424	254
August 24	Tanypodinae		0	0	0	0	509	0
July 5	Tanytarsini		0	0	0	42	ns	84
August 1	Tanytarsini		0	42	84	212	679	594
August 24	Tanytarsini		0	127	0	212	679	127
July 5	Lumbriculidae		169	0	42	0	ns	0
August 1	Lumbriculidae		84	0	0	0	0	12
August 24	Lumbriculidae		0	0	0	0	0	0
July 5	Enchytraeidae		0	0	0	0	ns	0
August 1	Enchytraeidae		0	42	0	0	0	0
August 24	Enchytraeidae		0	0	0	0	0	0
July 5	Gastropoda		2208	0	16560	1104	ns	1486
August 1	Gastropoda		297	0	42	636	0	0
August 24	Gastropoda		4838	0	254	763	0	0
July 5	Sphaeriidae		9214	0	3227	1656	ns	2250
August 1	Sphaeriidae		0	84	212	297	636	84
August 24	Sphaeriidae		84	169	0	3904	2376	551
July 5	Trichoptera		0	0	127	0	ns	0
August 1	Trichoptera		0	0	0	0	0	0
August 24	Trichoptera		1230	0	169	0	0	0
July 5	Ephemeroptera		0	0	0	0	ns	0
August 1	Ephemeroptera		0	0	0	0	0	0
August 24	Ephemeroptera		0	0	0	0	0	0